VOLUME 40
NUMBER 12

DECEMBER, 1953

plating

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CHRISTMAS GREETINGS

See Contents Page 1359

Greetings
Again we greet you at this Holiday Season . . . .
To You whose Friendship and Good will we Cherish may we say Thank you and also wish you a real Merry Xmas and a bright and successful New Year.
From FREDERICK GUMM Chemical Company Inc.
538 FOREST STREET, KEARNY, N.J.
CLEANING COMPOUNDS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1400.

Remove Grease and Grime in Seconds with ENTHONE *Emulsion Cleaner* 75

Heavy oil films and solid dirt are removed from steel almost instantly.

Tapped holes, embossments, corners, crevices, sculptured patterns are completely cleaned.

Gives smoother, brighter, more adherent electrodeposits.

Used before plating, it coats coatings it minimizes coarse coatings.

Safe for operators, does not irritate nose, throat or skin.

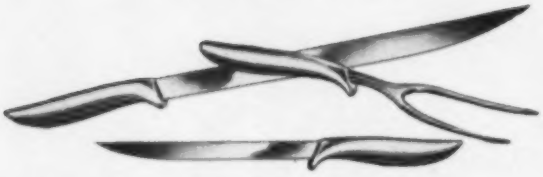
Requires no heating facilities.

Write for fully descriptive literature.

METAL FINISHING PROCESSES

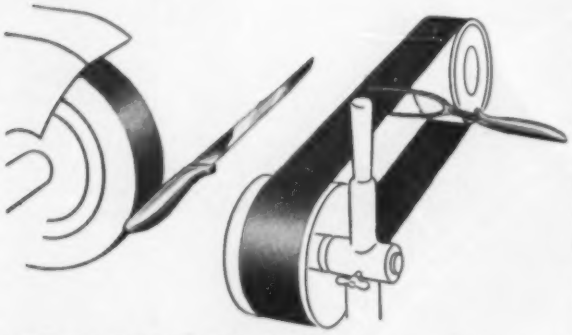
ELECTROPLATING CHEMICALS

How would you SOLVE IT?

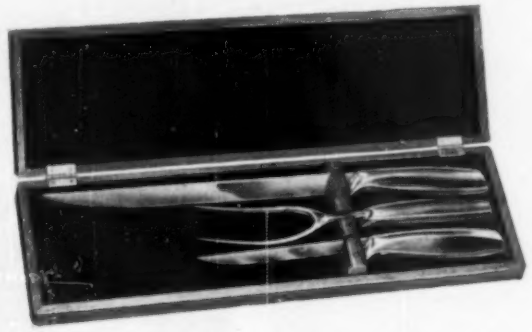


PRODUCTION PROBLEM: To cut unit costs of finishing cutlery sets and produce a more uniform finish. (Manufacturer was using set-up wheel method which finished only four blades an hour, left unsatisfactory finish.)

SOLUTION: 3M Engineering suggested that Gerber Legendary Blades of Portland, Oregon switch to the 3M Backstand Method, using Three-M-ite and Tri-M-ite Cloth Belts. This new method is currently *turning out 27 blades an hour*—six times the previous production!



KNIFE HANDLES' delicate lines and compound curves are brought out quickly, easily—**FORK TINES'** desired sharpness is easily produced. 3M Backstand Method gives the workman *complete control*. Lets him do better work in less time—every time.



RESULTS: Carving sets of matchless beauty finished at lower unit cost! 3M Sales Representatives can help *you* solve your grinding problems, too. Send coupon for facts.

Minnesota Mining & Mfg. Co.
Dept. PL-123, St. Paul 6, Minn.

☐ Have 3M Representative call

☐ Please send me FREE booklet . . .
"The 3M Method of Belt Grinding and Finishing"

Name_____

Company_____

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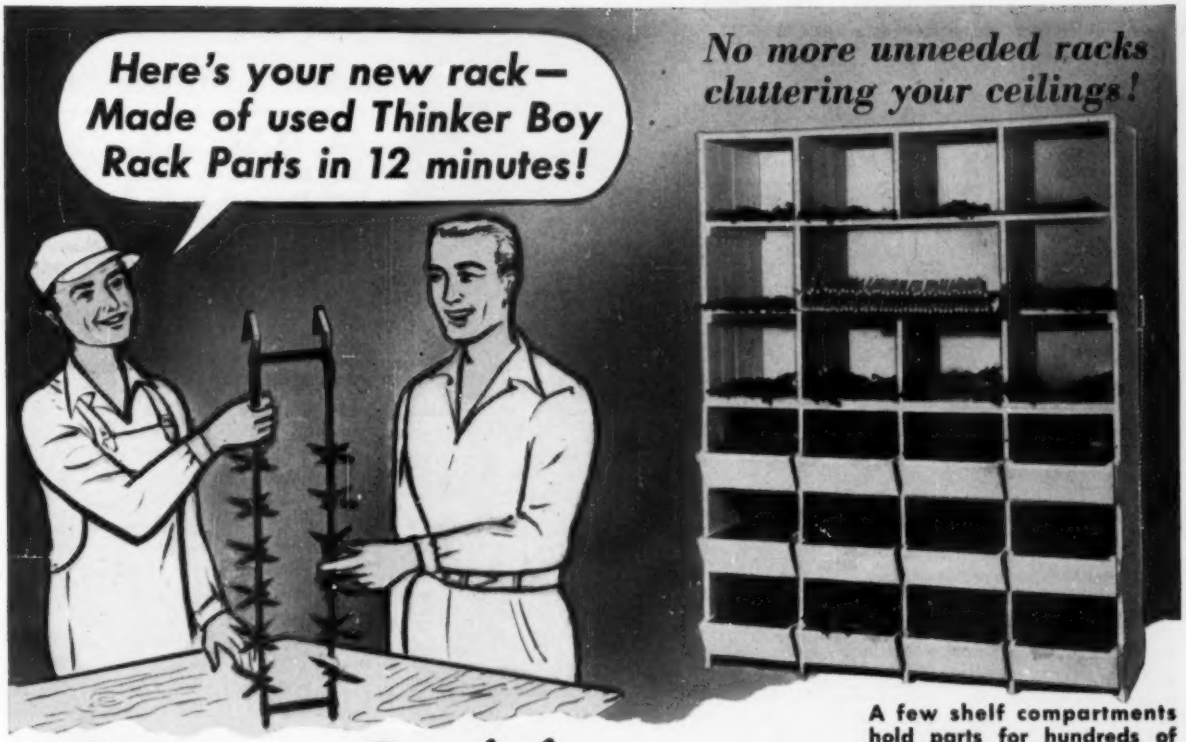
3M® ABRASIVES

Made in U.S.A. by **MINNESOTA MINING & MFG. CO.**
General Offices: Saint Paul 6, Minn. In Canada: London, Ont., Can.
Export: 122 E. 42nd St., New York City

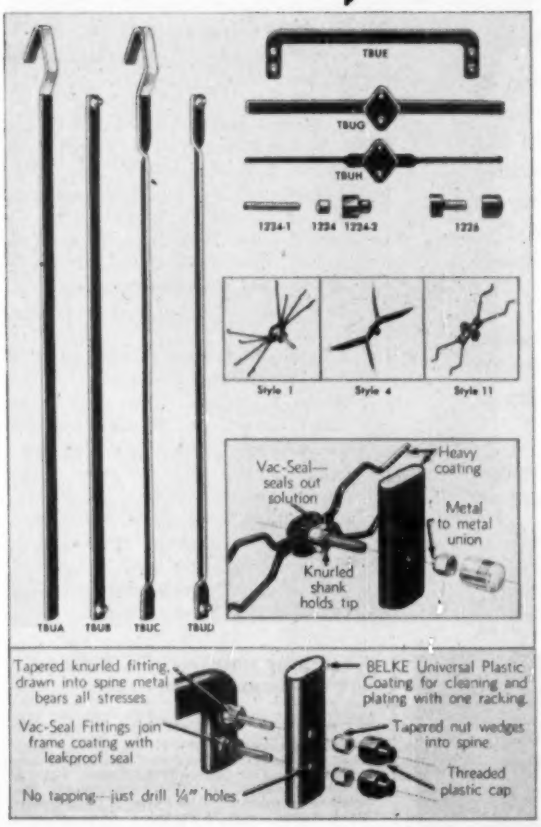
Makers of "SCOTCH"® Pressure-Sensitive Tapes • • • "SCOTCH"® Sound Recording Tape
"3M"® Adhesives • "UNDERSEAL"® Rubberized Coating
"SCOTCHLITE"® Reflective Sheeting • • • "SAFETY-WALK"® Non-Slip Surfacing

3M COMPANY



It's a Goldmine

A few shelf compartments hold parts for hundreds of Thinker Boy Racks! You use parts of unneeded racks to make new ones—Stop cluttering up ceilings with old worthless racks—cut 80% and more from racking costs.



Efficient, coated, plating racks of your own design—in a matter of minutes—for the mere cost of assembly from used rack parts. Even the tips are coated so nothing else has to be done.

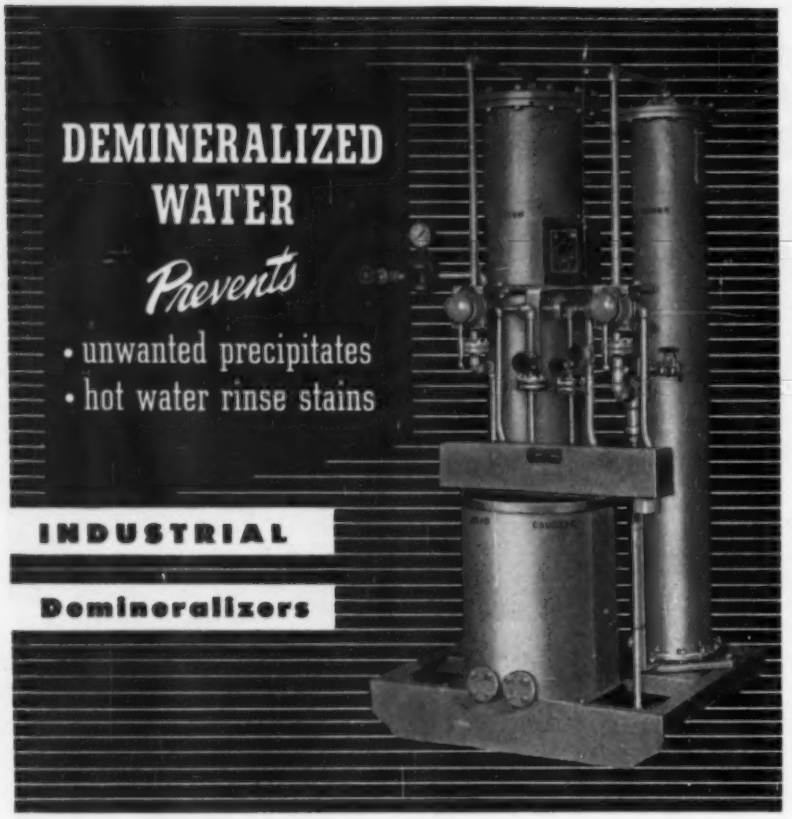
No extra investment necessary. Just get BELKE Thinker Boy Racks when you buy racks (either complete or unassembled). When racks are no longer needed disassemble and store the parts.

Instead of worthless racks cluttering your ceilings, *you soon have a goldmine of coated Thinker Boy Rack Parts.* You can quickly assemble completely coated racks of countless styles and spacings. Only the tip contacts are exposed to plating.

Thinker Boy Parts are mass produced for low cost. A 30" TBUA Spine and Cathode Hook, Universal Plastic coated ready to use is only $2.85.

For information *about the greatest time and money saving rack development in all plating history,* ask your BELKE Service Engineer or write.

Belke MANUFACTURING CO.
947 N. Cicero Ave.
Chicago 51, Ill
EVERYTHING FOR PLATING PLANTS



...and the cost is very low...

With an INDUSTRIAL demineralizer chemically pure water, in any quantity, runs as low as a few cents per thousand gallons, depending upon the amount of dissolved solids in the raw supply water. And the equipment required is very simple — no heat, steam, or cooling water is used. Units can be made to deliver almost any quantity of purified water. The operation is practically automatic — only limited attention is needed periodically.

INDUSTRIAL demineralizers are supplied with necessary equipment including resins, pressure gauge, flowmeter, purity indicator, control valves, and with vulcanized rubber lining in columns and regenerant tanks.

Standard INDUSTRIAL demineralizer units have capacities up to 1000 gph. Special units of any capacity are engineered to special requirements of quality or quantity.

Full particulars and recommendations for any job will be given upon request.

4383

INDUSTRIAL

FILTER & PUMP MFG. CO.

5914 Ogden Avenue, Chicago 50, Illinois

PRESSURE FILTERS
DEMINERALIZERS
RUBBER LININGS
CORROSION TEST CABINETS
HEAT EXCHANGERS

In This Issue

The American Electroplaters' Society Research Program by Dr. Donald Price is a review of recent AES Research Committee activities by the Chairman of the group. He touches on the problems of financing the various projects and mentions some of the recent work of Projects 5, 12, 14 and 15.

The Analysis of Electroplating Solutions for Major Constituents by Dr. Earl J. Serfass. The Vice-Chairman of the AES Research Committee discusses the reactivation of Project No. 2. One purpose behind the step was to study all analytical methods now used for the determination of major constituents of electroplating baths with the development of simplified control methods as a major goal.

The Effect and Removal of Chromium from Nickel Plating Baths by Dr. D. T. Ewing, J. K. Werner, A. A. Brouwer, C. J. Owen, and W. O. Dow. This paper is the seventh of a series submitted by Project No. 5. The effects of hexavalent and trivalent chromium on the appearance, adhesion, ductility salt-spray corrosion resistance, hardness and throwing power of nickel deposits are reported. The study covers high and low *p*H Watts', nickel-cobalt and organic brightener type solutions.

A Metallographic Study of Some Steels Used for Nickel Plating by Dr. A. E. R. Westman and Dr. F. A. Mohrnheim. This progress report from Project No. 14 details the work performed in the metallographic examination of steels. Techniques described are: conical illumination, phase contrast illumination and taper sectioning.

Progress Report on Development of a New Accelerated Corrosion Test by Walter L. Pinner. This progress report of Project No. 15 work describes the uniqueness of organization and procedures employed by the group. The Project program, already under way, calls for the study of the performance in test and in service of decorative plated coatings over steel in terms of their behavior in use on test vehicles in Detroit during the winter months.

For page numbers, see Table of Contents, page 1359

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That's because its wide impurity tolerance allows easier control, gives better covering power, results in *exceptionally* bright deposit. And what's more important—with agitation, you can increase current densities up to 70 amp./sq. ft., which makes H-VW-M's Cadux HS (high speed) Process—in barrels or on racks—*faster, brighter, better!* And that's not all . . .

This *exclusive* Cadux HS (high speed) bright cadmium process is the result of over eighty years of constant electroplating development—a continuing policy summed up in H-VW-M Platemanship . . . your working guarantee of the best that industry has to offer—not only in a bright cadmium finish—*but in every phase of plating and polishing.*

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PLATING & POLISHING PROCESSES • EQUIPMENT • SUPPLIES

Ask for the Technical Instruction Manual.

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

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H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

BECKMANODIZING

the new term in plating plants everywhere for accurate pH controlled ANODIZING!

Solve your troublesome anodizing problems once and for all by using BECKMAN pH Control—a "must" in anodizing aluminum by the sulfuric acid or chromic acid methods where careful pH ranges have to be maintained. By far the fastest, simplest—and in the long run—cheapest way to measure pH accurately is with Beckman Glass Electrode pH Meters. Because Beckman pH Equipment does the job better for less—because Beckman has been responsible for nearly all major advances in this field—you owe it to yourself to investigate how BECKMAN can untangle your production snarls and cut costs.

"Beckman pH Instrumentation is absolutely essential for close control in anodizing!", says Crown City Plating Company. For full details, see your Beckman Dealer, or write for Data File 62-72

GENERAL PURPOSE — Beckman Model H-2 pH Meter. A line operated "workhorse" designed for plug-in convenience on 115 v AC circuits and 24-hour duty. Permits instant measurements without turning on and adjusting instrument.

PORTABLE — Beckman Model N pH Meter. This compact, easily carried traveling laboratory contains everything you need for making pH measurements around your plant. Low price, light weight, battery-operated. Accuracy within 0.03 pH.

Beckman *division*

BECKMAN INSTRUMENTS, INC.
SOUTH PASADENA 1, CALIFORNIA

Industry News

New Wyandotte Chlorine Unit in Operation. Wyandotte Chemicals Corporation announced the bringing on stream of its new 300-ton chlorine unit, completing a broad expansion of its manufacturing and research facilities in Wyandotte, Mich.

As a result of the program, Wyandotte has increased its output of soda ash by 20 per cent and chlorine by 75 per cent, enabling it to strengthen materially its service to glass, soap and detergent, metal working, pharmaceutical, food, synthetic fibre and other major industries which use large tonnages of such products, and to meet needs which might be imposed by the nation's defense program.

3M Expanding "Honite" Distributor Organization. Expansion of the distributor organization for "Honite" barrel finishing abrasive chips, compounds and equipment has been announced by Minnesota Mining and Manufacturing Company, St. Paul, Minn.

"To date twelve distributors have been appointed in major industrial centers—the nucleus of a distributor organization designed to eventually make 'Honite' sales and service available in every important metal finishing center in the country", according to John S. Coppage, merchandising manager of 3M's "Honite" division.

Distributors are already located in the following cities: Micro Deburring Co., Chicago, Ill.; Mechanical Finishing Co., Cincinnati, Ohio; Metals Finishing Corporation, Hazel Park, Mich.; Metal Parts Processing Co., and Metal Finish, Inc., Newark, N. J.; M. E. Baker Co., Cambridge, Mass.; Deburrco, Inc., Philadelphia 32, Pa.; Gerell Mfg. Co., Cleveland 14, Ohio; Mosher Co., Chicopee, Mass.; Precision Tumbling & Supplies Co., Stratford, Conn.; Sundmark Supply Co., Los Angeles, Calif.; and Tumbling Products, Inc., Indianapolis, Ind.

Wagner Brothers in Titeflex Production. Wagner Brothers, Inc., Detroit manufacturers and distributors of electroplating equipment and supplies, has purchased from the Atlas Corp. manu-

Additional AES Sustaining Memberships continue to come into Headquarters. The latest membership, one reported by the New York Branch is:
Prime Plating Works, Inc.
Brooklyn 21, N. Y.

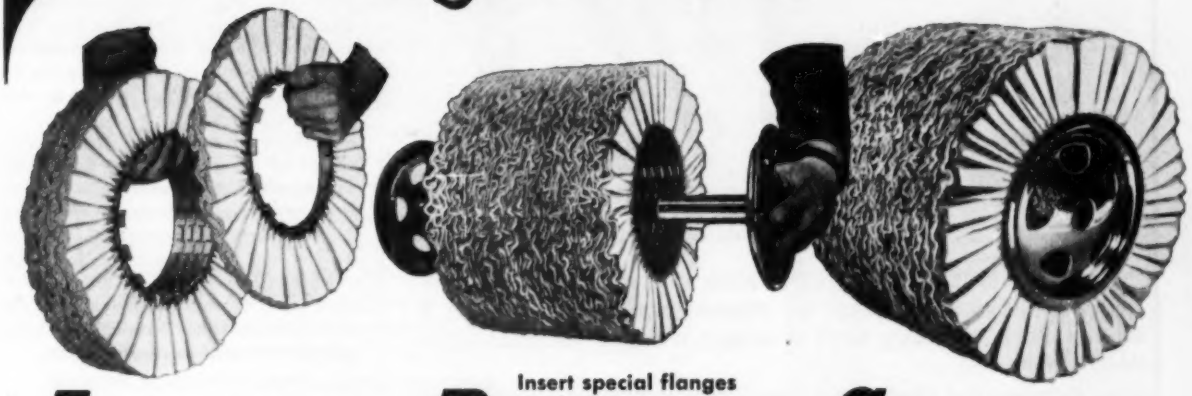
ONLY

Automatic Centerless Buffs

CUT COSTLY CHANGE-OVERS WITH patented "Pre-Assembly"

(U. S. PAT. NO. 2,599,785)

Easy as A·B·C!



A. Lock individual buffs together to build up head of desired width

B. Insert special flanges with "telescoping" *hollow* shafts

C. Press shafts together—*Pre-Assembled* unit is ready to install!

Remove *USED BUFFS* as one unit!
Reload *NEW BUFFS* as one unit!
Change buffs in *SECONDS* . . .
instead of *MINUTES* or *HOURS*!

NO OTHER BUFF has the Automatic "PRE-ASSEMBLY" feature—a buff-changing method so unique . . . so superior . . . that it has been granted a patent by the U.S. Patent Office!

Exclusive "LOK-TITE" Ring construction locks buffs firmly together—eliminates costly down-time of one-by-one removal and replacement. Complete heads can be *pre-assembled* in your stockroom—ready for *fast* change-over!

ASK FOR A DEMONSTRATION, IN YOUR OWN SHOP!

WRITE FOR FREE BUFFING CALCULATOR

Ideal for shop foremen. Instantly answers every buffing question — tells what buff to use for any job.

AUTOMATIC BIAS AND SISAL BUFFS

are available with Centerless, Permanent Steel Center or Cardboard centers.

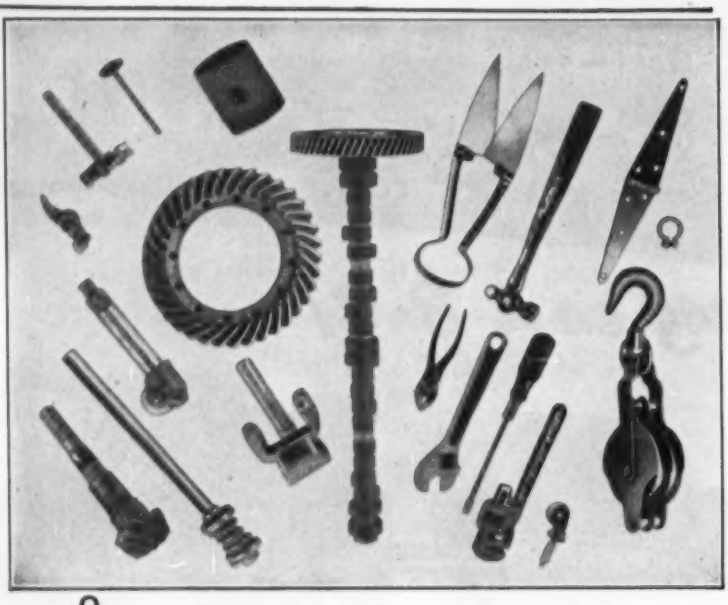
AUTOMATIC BUFF CO.
DIVISION OF

American Buff Company

CHICAGO 16, ILLINOIS — CAlumet 5-1607

AMERICAN CHEMICAL PAINT COMPANY
AMBLER CHEMICALS ACP PROCESSES PENNA.

Technical Service Data Sheet
Subject: RUST PROOFING WITH PERMADINE®



Steel parts that have been Permadized and then "sealed" with a rust-preventive oil such as "Granoleum" are effectively protected from rust. And, if the oiled "Permadine" coating should be damaged, rusting will not spread beyond the area of exposure.

Note: Automotive and other rubbing parts subject to friction are usually given "Thermoil-Granodine" manganese-iron phosphate coatings for both wear-resistance and protection from corrosion.

DATA ON THE "PERMADINE" COATING	
Type of coating	Zinc phosphate
Object of coating	Rust and corrosion prevention
Typical products treated	Nuts, bolts, screws, hardware items, tools, guns, cartridge clips, fire control instruments, metallic belt links, steel aircraft parts, certain steel projectiles and many other components
Government Specifications	U.S.A. 57-0-2C; Type II, Class B MIL-C-16232, Type II U.S.A. 51-70-1, Finish 22.02, Class B AN-F-20 Navy Aeronautical M-364 JAN-L-548
Scale of production	Large or small volume; large or small work
Method of application	Dip Barrel tumbling, racked or basketed work
Equipment notes	Immersion tanks of suitable capacity. Cleaning and rinsing stages can be of mild steel. Coating stage can be of heavy mild steel or stainless steel.
Chemicals required	"Permadine" No. 1
Pre-cleaning methods	Any common degreasing method can be used. Alkali cleaning ("Ridosol"), Acid cleaning ("Deoxidine"), Emulsion-alkali cleaning ("Ridosol" - "Ridoline"); vapor degreasing, solvent wiping, etc., are examples. Acid cleaning may need to follow other cleaning methods if rust or scale is present.
Bath Temperature	190° - 205°F.
Coating time	20 - 40 minutes
Coating weight range	1000 - 4000 mgs. per sq. ft.
Technical Service Data Sheets	No. 7-20-1-2 T.M. No. 5

CHEMICALS ACP PROCESSES WRITE FOR FURTHER INFORMATION ON "PERMADINE" AND YOUR OWN METAL PROTECTION PROBLEMS CHEMICALS ACP PROCESSES

Industry News

facturing and sales rights for Titeflex filters to the electroplating and metal working fields. The first units built in the new plant of Wagner Brothers Equipment Co., at Wayne, Mich., have been shipped and the plant is being tooled to build all standard models and special units of the well-known filter which range in capacity from 1 sq ft to 500 sq ft filtering area.

The filter features simplified vertical membranes, retaining a medium of diatomaceous earth, cleaned by reversal of flow without disassembly.

AEC Approves Diamond Alkali. The Atomic Energy Commission has approved the addition of Diamond Alkali Company, Cleveland, Ohio, for the purpose of expanding the activities of the industrial study team of Foster Wheeler Corp., New York, and Pioneer Service & Engineering Company, Chicago. The latter firms have been participating in the Commission's nuclear reactor development program for the application of atomic energy to electric power generation.

Diamond Alkali becomes the chemical partner of the group. This follows the original planning of the team to have an experienced chemical company, along with the manufacturing experience of Foster Wheeler and the power plant design experience of Pioneer, to constitute a diversified group having a background in the various technical fields anticipated in the peaceful utilization of atomic energy.

Beckman Forms Government Contracts Division. Arnold O. Beckman, president of Beckman Instruments, Inc., announced the formation of a new operating division to handle development, engineering and production work under selected government contracts.

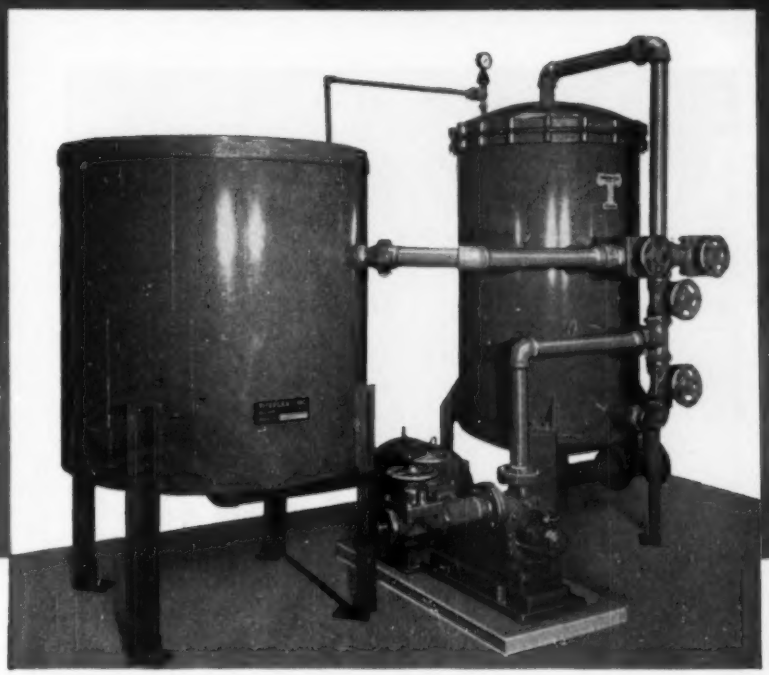
General manager for the new Arga division will be J. L. Fahey, vice-president and controller of Beckman Instruments, Inc. The division will be located at 220 Pasadena Ave., South Pasadena, Calif.

The managerial and engineering staff will include Arnold Raines, Herbert Galman and Armand Adams, formerly in

WANTED!
BUFFING COMPOUND SALESMEN

Distributors, Jobbers and Manufacturers Agents to distribute and sell the full line of Schaffner's Polishing and Buffing Composition in Bar, Spray or paste form and a complete line of supplies.

Schaffner Manufacturing Company, Inc.
Emsworth, Pittsburgh 2, Pa.



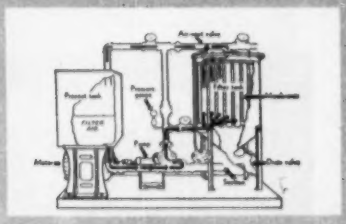
NOW–

New WAGNER Titeflex Filters end your filtering headaches

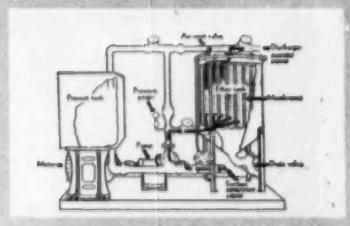
The outstanding simplicity and efficiency of Titeflex Filters are now backed up by the manufacturing facilities and electroplating experience of Wagner Brothers, Inc. Our acquisition of this leader in the filtering field means you now have Titeflex' faster cleaning, high flow rate and low operating cost *plus* the on-the-spot service of the Wagner Brothers organization in principal industrial areas.

Removal of sludge and other impurities (down to 1/10 micron) which are injurious to your plating quality is a cinch with Titeflex filters. Titeflex pumps the bath or cleaner through permanent membranes caked with a few cents worth of a filtering aid (diatomaceous earth). To clean, you turn a few valves and reverse the flow. There's no replacement, no manual cleaning labor, no dismantling. Your loss of filtering time is a matter of *minutes*. And the filtering operation requires fewer hours of inexperienced labor than any other equipment of comparable filtering efficiency.

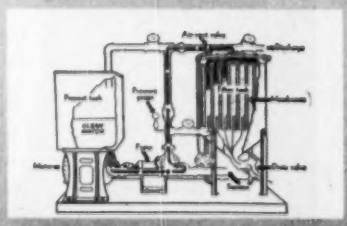
The complete standard line of Wagner-Titeflex Filters offers capacities from 1000 G.P.H. up, filter areas from 3 to 70 sq. ft.; special equipment designed and built to suit your requirements. Mail coupon on your letterhead for detailed information and filtering questionnaire. If you're a plating equipment distributor, ask about territories open.



PRECOATING: Coke of low-cost filter-aid is built up in minutes on exterior of cylinder membranes.



FILTERING: Sediment is deposited on layer of filter-aid, clear solution discharged from upper end of membranes.



CLEANING: Coke is cracked off by back-washing, broken up by built-in spray and drained off. No manual removal of residue.

Titeflex

YOUR SINGLE SOURCE FOR PLATING AND POLISHING EQUIPMENT AND SUPPLIES

Wagner BROTHERS INC.

DETROIT 3, MICHIGAN

CHICAGO ROCHESTER CLEVELAND

CINCINNATI INDIANAPOLIS

WAGNER BROTHERS, INC. 425 Midland, Detroit 3

- ☐ Please send complete literature regarding Titeflex Filters.
- ☐ Have sales engineer call.
- ☐ We are interested in a Titeflex Filter distributorship.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

Industry News

charge of Arga Instrument Company of Southampton, Pa. The eastern firm will continue in operation until completion of existing contracts, and then transfer to California.

Revocation of DSM 1. Revocation of a regulatory measure titled "Designation of Scarce Materials 1" has been announced by the Business and Defense Administration, Department of Commerce.

Designation of Scarce Materials 1 was issued by the National Production Authority, predecessor agency to BDSA, to carry out the anti-hoarding provisions of the Defense Production Act.

The document specified as scarce the strategic alloying materials chromium, cobalt, columbium and tantalum, molybdenum, and nickel, and also diamond grinding wheels.

Commemorating Belke Manufacturing Company's thirtieth anniversary, employees presented a large cast bronze model of the Company trade mark to William E. Belke, President, and Founder. Seated, left to right, Harvie Johnson, Ralph Belke, William E. Belke, and Larry Verfurth

Since Government controls over the use, allocation, and inventory of these items have been revoked, except for regulations which assure delivery of military and atomic energy orders, BDSA officials said continuation of this designation no longer is warranted.

Address Change. R. S. Aries & Associates, consulting chemical engineers and economists, have moved their executive offices to 270 Park Ave., New York, N. Y.

The expansion of Aires' activities in recent years has made necessary the move to larger quarters. The new offices have four times the area of the old quarters at 400 Madison Ave., and will permit departmental organization and the consolidation of activities for more efficient operations.

Crown Chemical Opens San Francisco Branch. In order to better serve its many customers in the bay area Crown Chemical and Engineering Co. opened a branch office and warehouse in

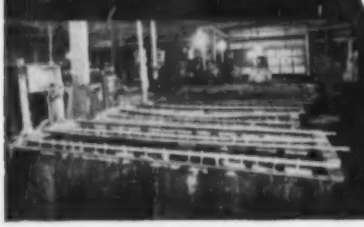
A SOLUTION FOR EVERY CLEANING PROBLEM

The PERMAG line of cleaning compounds for the electrolytic cleaning process of the plating industry makes possible a solution for every cleaning problem.

With the skill and knowledge developed in over 30 years of service, PERMAG cleaning compounds are designed to provide maximum cleaning efficiency at the lowest possible cost to ease your daily operations and increase production.

PERMAG technical service is also available without obligation to assist you in any unusual or difficult cleaning question you may face. Why not take advantage of it today?

Write for your FREE Electroplaters Handy Pocket Size Manual on Cleaning Compounds.



MAGNUSON PRODUCTS CORPORATION

50 Court Street • Brooklyn 2, N. Y.

In Canada:
CANADIAN PERMAG PRODUCTS, LTD.,
MONTREAL

ELECTRO OR INORGANIC CHEMIST

Position in research and developmental laboratory of growing Southwestern New York company specializing in electrodeposition for engineering uses. Must be capable of conducting supervised research on process and product development. Ability to work cooperatively with plant personnel on production problems required. Give full details in first letter. Salary open. *Reply to:*

P-1253-A, PLATING
445 Broad St., Newark 2, N. J.

Udylit

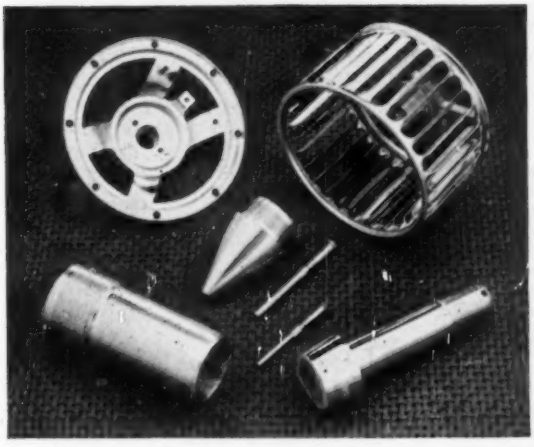
LABORATORY CONTROL MAKES THE DIFFERENCE!

In *cadmium plating*, good results, time after time, are due to tested supplies and ingredients. Quality must never vary. That's where Udylite thoroughness pays off!

"Uniformity through laboratory control" is the keynote of all Udylite supplies. For example, check these materials used with new Udylite BRY-CAD:

- The unvarying purity of Cadmium Ball Anodes—which Udylite originated—is an example of Udylite uniform quality. All anodes are spot-checked to maintain uniformity of size, content and weight.
- Udylite Ball Anode containers are designed to use anodes to the last ounce—as well as maintain maximum anode area.
- Udylite Cadmium Salt #153 contains all basic components of the cadmium bath. You can be sure that the chemicals used are finest quality . . . and mixed in EXACT proportions for best results.
- Udylite Brightener #53 used in the BRY-CAD Process results from years of laboratory research.

Note various items of intricate shape plated with the new Udylite BRY-CAD.

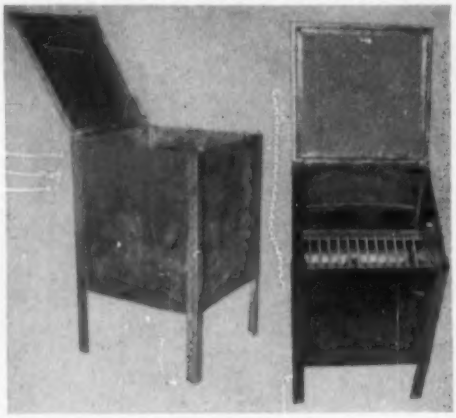


So . . . for best results . . . for uniformity in plating on YOUR jobs . . . choose Udylite anodes, containers, materials. Call your Udylite technical man or write direct for complete lists of supplies. THE UDYLITE CORPORATION—DETROIT 11, MICHIGAN. *West of Rockies, L. H. Butcher Co., Los Angeles 23, California.*

PIONEER OF A BETTER WAY IN PLATING

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

You Get Bigger Tank Values with Stortswelding



From a single rinse tank for replacement to a complete new plating tank cycle, welding by Storts is your assurance of maximum service life for your tanks. Storts has fabricated many thousands of plating tanks with welding that outlasts the construction material.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1412.

Chromic Acid

CrO_3

for

DECORATIVE PLATING
HARD CHROMIUM PLATE
ANODIZING ALUMINUM
CHEMICAL CONVERSION COATINGS
STRIPPING COPPER
METAL CLEANING BATHS
ORGANIC SYNTHESIS
MANUFACTURE OF CATALYSTS

The Mutual name and trade mark on a Chromic Acid drum guarantee a product with a minimum assay of 99.75% and a sulfate content not exceeding 0.1%. Chromic Acid of that purity may be used with confidence in any of the applications shown here.

MUTUAL SINCE 1845

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE • NEW YORK 16 N. Y.

Industry News

San Francisco at 1 Dorman St., on June 1. Company headquarters and main plant are at Los Angeles where Luster-On products and other Crown specialities are manufactured. Complete stocks are maintained at the San Francisco facility, including the products of R. O. Hull & Co., Crown Rheostat, and The Chemical Corporation, as well as other equipment and chemicals for the metal processing industry.

New Business and Defense Services Administration. Secretary of Commerce, Sinclair Weeks, announced recently the establishment of the Business and Defense Services Administration, a primary organization unit in the Department of Commerce.

The new agency: (a) continues the residual defense and mobilization functions of the former National Production Authority, as authorized by law; (b) consolidates five current departmental offices; (c) establishes 25 industry divisions staffed by business experts from government and private industry, and (d) provides a focal point for effective cooperation between government and business in promoting economic stability and growth.

The offices transferred to the BDSA are: the Office of Technical Services, the Office of Distribution, the Field Service, staff functions of the Industry Evaluation Board, and the Office of Industry and Commerce, including its Trade Association, Commodities Standards and Area Development Divisions.

More Zirconium to be Available. Zirconium, a metal which long has been extremely difficult to refine, soon will be available for use in chemical equipment as well as in atomic energy installations. A commercially practical method for refining it has been developed only recently.

This became known with the announcement from the Pfaudler Co. that it had manufactured and shipped processing equipment for the large new zirconium plant being built at Akron, N. Y., by Carborundum Metals Co., Inc., a subsidiary of Carborundum Co., Niagara Falls, N. Y.

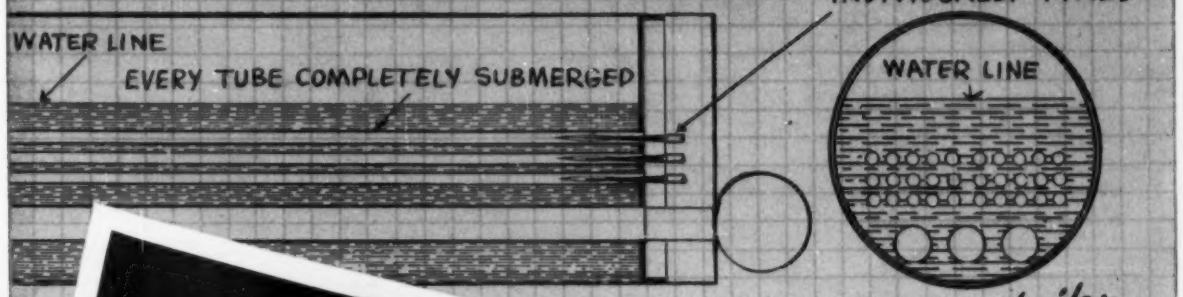
PARTNER WANTED

Partnership available for an electroplater and polisher with job shop experience, to take full charge of an old established concern in Monmouth County, New Jersey. High weekly income assured. Modest investment required. *Reply to:*

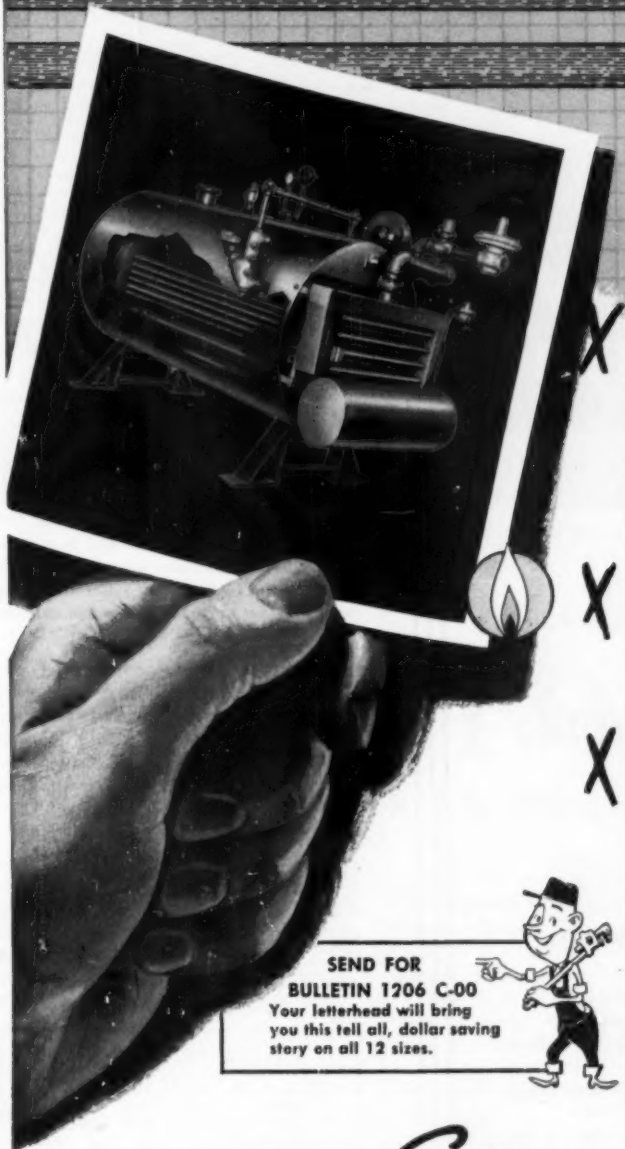
P-1253-B, PLATING
445 Broad St., Newark 2, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1413.

when you buy a steam boiler . . . be sure to look at the picture of a Sellers Immersion Boiler



There's no other boiler like a Sellers—



every square foot of heating surface is water backed— —100% effective!

The long, individually gas fired tubes in the Sellers Immersion Boiler are all completely submerged nearer the water level—and over the return tubes! Heat is therefore uniformly distributed through them—and directly into the water—no where else!

there's no scale problem!

In immersion heating, the needed long tubes expand and contract sufficiently on intermittent firing to crack loose any hard scale that forms on the tubes. This practically eliminates the scale problem, makes maintenance simpler and increases the boiler's efficiency.

the average flue gas travel is 15 feet!

Maximum, almost complete utilization of the exhaust heat is assured with a Sellers Immersion Boiler. This is a result of Sellers exclusive design—with the firing tubes completely submerged and *located over the return tubes,* there is a long, slow flue gas travel—an average of 15 feet! Heat can only go into the water.

There's no other steam boiler like a Sellers Immersion Steam Boiler. Its simple design gives you a package boiler unit with many other outstanding features. Minimum maintenance and maximum efficiency combine to give you years of remarkably low operating costs. Twelve sizes available!

SEND FOR BULLETIN 1206 C-00
Your letterhead will bring you this tell all, dollar saving story on all 12 sizes.

Sellers ENGINEERING CO.

4876 N. CLARK STREET CHICAGO, ILL.

Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Immersion Steam Boilers

Industry News

Zirconium, which passes neutrons and possesses unusual corrosion resistance is used as a construction material for atomic energy reactors. Soon it will be available as well for chemical equipment, pipes, valves, tubes, and pump liners.

While zirconium is the 14th most prevalent material in the earth's crust, being more common, for example, than copper, it is extremely difficult to isolate. The metal sells today at $28 to $32 per pound, in the form of sheets, rods, tubes, etc.

Industrial Course Completed. The Atlas Mineral Products Company has completed the presentation of the first industrial course on "Plastic Materials of Construction". The course was held in classrooms at the general offices of the Company at Mertztown, Pa.

Plans are underway to repeat the course as often as necessary in order to take care of the heavy demands and interest that has been expressed. Those interested should contact Joseph A. Snook, Atlas Mineral Products Co., Mertztown, Pa.

Report of the Tin Research Institute for 1952. The annual report of the Tin Research Institute for 1952 states that the various groups of tin producers who provide the funds have unanimously agreed to increase their contributions by 50 per cent in order to strengthen the Institute's staff and especially to increase its free technical services to industry in the chief tin consuming countries of the world. Following this additional grant, information centers were opened in Canada, France, Italy, and Sweden; centers already existed in Belgium, Holland, and the United States; the Institute's headquarters and laboratories have been at Greenford, Middlesex, England since 1938.

Mention is made in the report of a number of applications of tin which originated from research at the Institute. The decorative tin-nickel electroplate has had difficulties during its first two years, but a suitable filtering medium has now been found. Tin-zinc electroplate, a corrosion-resistant coating, has found many further uses in the radio, motor-car and aircraft industries.

Tebben Heads New Equipment Firm. John D. Tebben, well known management consultant, has been elected president and chairman of the board of the recently organized Wagner Brothers Equipment Co.

The firm was formed by a group of employees of Wagner Brothers, Inc., manufacturers and warehouse suppliers to the plating industry, and will build electroplating equipment, headlined by a revolutionary, fully automatic electroplater. Other items include electroplating rectifiers, a package unit plater, semi-automatics, agitators, tanks and anode containers.

Film on Industrial Research. A new 10-minute, 16mm color-sound film, "It's Only the Beginning", telling the story of industrial research and its contribution to the ultimate consumer, is now available on a free loan basis from the Scientific Apparatus Makers Association, 20 N. Wacker Dr., Chicago 6, Ill.

Program chairman of technical and civic groups, science teachers and representatives of other interested organizations may also make arrangements for the showing of the film by contacting any one of the 206 manufacturer and supplier members of SAMA.

J. J. Siefen Company Election. The J. J. Siefen Company announces the election of John F. Siefen to the Presidency of the Company. Other officers are: I. E. Siefen, Vice-President and Treasurer, and John R. Siefen, Secretary.

POSITION WANTED

METALS TECHNOLOGIST: Southern Connecticut resident. Broad theoretical and practical background in analytical and inorganic chemistry, non-ferrous metallurgy and the specification electroplating of the precious and platinum group metals. Can exercise varied capabilities. *Reply to:*

P-1253-C, PLATING
445 Broad St., Newark 2, N. J.

BRASS PLATING WITH TRUE BRITE

❶ improve color

❷ save labor

❸ eliminate supervision

❶ *color stays constant . . . no rejects*

❷ *eliminates frequent analyses . . .*

❸ *trouble free . . . only one addition instead of three*

Write for FREE bulletin! Your key to better Brass Plating

Available in regular 3 to 1 ratio for yellow Brass Plating.

Special ratio materials for plating richlow brass or any other desired alloy of copper and zinc.

Suitable for both still tanks and barrels.

TRUE BRITE CHEMICAL PRODUCTS CO.

P. O. Box 31, Oakville, Conn.

ONE OF A NUMBER of different tumbling barrels in which sample parts are processed in the new Norton barrel-finishing department.

Get the

"TOUCH OF GOLD"

Sample tumbling FREE in the new Norton test department

Can you "tumble" with the "Touch of Gold"? Can you be sure that you are adding value to your product each time the barrel turns in the barrel-finishing operation? Have you investigated this method as a way to more efficient processing and higher profit?

You can get samples processed without cost — in the newly enlarged Norton sample processing department with tumbling barrels of different types and capacities, plus auxiliary equipment such as a mechanically vibrated screen. Here Norton engineers, long experienced in tumbling procedures, determine for you just what barrel-finishing can do for the metal parts you send.

The range is wide. We have been successful in finishing parts ranging from tiny needles to castings and forgings weighing several pounds. Many manufacturers already have the "Touch of Gold" with substantial savings and production speed-up.

Tests result in detailed recommendations on barrel type, size, speed and amount of ALUNDUM* Tumbling Abrasive, amount of water, type and amount of compound or cleaner, time cycles and other data.

No obligation — send now. Mail us your representative sample parts plus (a) finished sample to be matched and (b) information on your present barrel-finishing equipment, if any, including type, size and speed of barrel. Send to NORTON COMPANY, Worcester 6, Mass., attention Sales Engineering Dept., Abrasive Division. Tests take about a week.

Also available is a 55-page Norton handbook on barrel-finishing. Ask your Norton Distributor for Form 501 or write us direct.

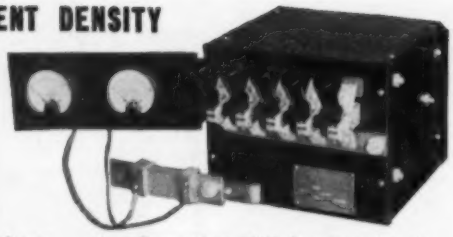
*Trade-Mark Reg. U. S. Pat. Off.

NORTON COMPANY, Worcester 6, Mass.
Distributors in All Principal Cities
Export: Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

NORTON
ABRASIVES
Making better products to make other products better

FOR THE RIGHT CURRENT DENSITY

USE COLUMBIA TANK RHEOSTATS



It's easy to adjust your tank voltage to suit the load with a Cast Grid Type Columbia Tank Rheostat. Standard sizes from 15 to 5000 Amperes, 1 to 6 Volt drop. Other voltage drops as specified.

COMPARE THESE OUTSTANDING FEATURES

- Cast Grid Resistors, rugged and resistant to chemical fumes.
- Cam Operated Toggle Switches, quick break, self-cleaning, positive contact, readily accessible, easily operated.
- Rugged construction and liberal design provide ample capacity for intermittent and momentary overloads.
- Entire rheostat, including instruments, easy to install.

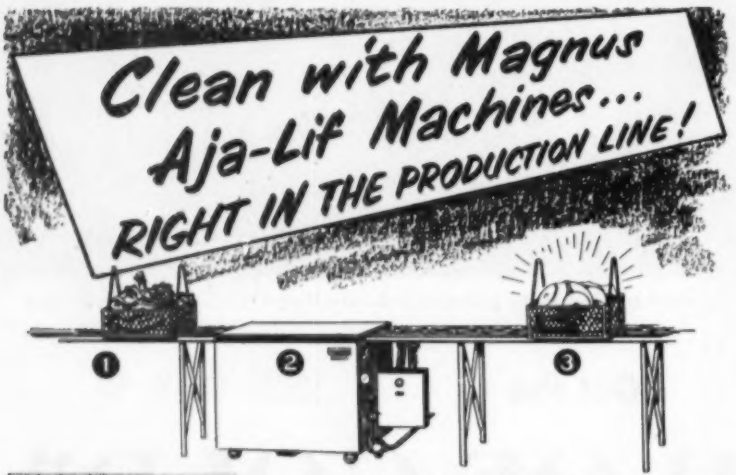
WRITE FOR BULLETIN PL-500

COLUMBIA ELECTRIC MFG. CO.

4533 HAMILTON AVENUE CLEVELAND 14, OHIO

Also Manufacturers of Motor Generator Sets, Reversing Switches, Tong Test Ammeters

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1417.



AJA-LIF IN PRODUCTION LINE. Work is loaded and unloaded at top of machine. 1—Dirty parts from processing; 2—Cleaning in Aja-Lif; 3—Cleaned parts to finishing.

Magnus Aja-Lif Cleaning Machines bring you all the advantages of speed and thoroughness of the Magnus Aja-Dip principle of metal cleaning. Added to the chemical action of the cleaning solution is the vigorous and effective mechanical scouring and shearing action obtained while the work is moved up and down in the solution 90-180 times a minute.

***In addition,* with the Aja-Lif Machine, you load the work on the machine at waist level. When you press the starting button, the platform drops as the cover closes, and agitation starts. When ready to unload, the machine stops and the platform returns to waist level. The machine fits perfectly into the production line!**

COMPRESSED AIR OPERATED . . . no gears, speed reducers or belts. No motors or electrical connections. Heating source to meet your needs.

WRITE FOR BULLETIN AL-701, containing the complete story on this unique metal cleaning machine.

MAGNUS CHEMICAL CO., INC.

41 South Ave., Garwood, N. J.

In Canada: Magnus Chemicals, Ltd., Montreal

Service Representatives in Principal Cities

magnus

Industry News

Detrex Conference. Michigan and Northern Indiana sales representatives of the Industrial Equipment Division of the Detrex Corporation, Detroit, have concluded a conference on "creative selling".

The conference, described as a refresher course in the numerous applications for metal degreasing equipment, was presided over by David E. Williard, sales manager of the division.

A. O. Thalacker, Detrex president, reported that the consumption of industrial cleaning solvents in the country this year represented a 20 per cent increase over 1952.

Use of ultrasonic waves to clean intricate metal parts, a development pioneered by Detrex, was demonstrated at the conference.

Precision Precious Metal Plating Firm Established. Harper-Leader, Inc., of 1046 S. Main St., Waterbury, Conn., was recently established by Perry J. Sloane and Isidore Cross.

Specializing in precision plating of the precious metals such as gold, silver, platinum, rhodium and palladium, Harper-Leader, Inc., backed by sound practical experience and flexibility of operation, caters to the many industries using precious metals.

P. J. Sloane has had extensive experience in the precious metal field, having served as technical director of Donham & Craft, Inc., chief chemist at Benrus Watch Co., and chemist and plating foreman at Oakville Co. Division, Scovill Mfg. Co. Sloane was graduated from Columbia University and attended Ohio State University Graduate School.

Cross has been actively engaged in the metal and organic finishing field for many years, both as production supervisor and as a consultant. He was associated with the Turner & Seymour Mfg. Co. and H. Goodman & Sons as finishing supervisor and was one of the principals of the former Hycrow Co. He is also one of the pioneers in vacuum evaporation. Cross was graduated from the College of The City of New York and continued his education at Brooklyn Polytechnic Institute Graduate School.

Bridgeport Brass Opens Grand Rapids Office. The Bridgeport Brass Company announced the opening of a new sales office in the Federal Square Building in Grand Rapids, Mich., to handle the sales of all Bridgeport products, including mill products, plumbing, brass goods, copper water tube and pipe.

The office will be under the direction of Thomas H. Williams, who was formerly connected with sales activities in the company's Indianapolis Sales Office.

MODERN METALS *Need Modern Chemicals*

Investigate B&A *Fluorides and Fluoborates*

The Light Metal Industry

1. **Alkali Fluoborates** (Ammonium, Potassium, Sodium)
   For use as purifying and melting fluxes, oxidation inhibitors, grain refining agents, and for heat-treating.
2. **Potassium Chromium Fluoride**
   To introduce small quantities of chromium in aluminum alloys.
3. **Potassium Titanium Fluoride**
   For grain refining and improved tensile strength.

The Electroplating Industry

4. **Metal Fluoborates** (Lead, Tin, Iron, Copper, Nickel, Cadmium, Indium)
   Electrolytes for plating baths; help increase plating output, lower operating costs, conserve critical plating metals.
5. **Sodium Acid Fluorides**
   For use in acid plating baths.
6. **Magnesium Fluoride**
   For use with chromic acid for surface treatment of magnesium.

Gray Iron Castings

7. **Potassium Fluoborate**
   To increase fluidity, machinability and tensile and transverse strengths.

Steel

8. **Sodium Fluoride** – For rimming.

Powdered Metallurgy

9. **Ammonium Fluoborate**
   To impart desired porosity.

Other B&A Fine Chemicals for the Metal Industry:

10. Acid Fluoboric
11. Acid Hydrofluoric, Reagent
12. Aluminum Chloride, Solution
13. Aluminum Fluoride, Crystal
14. Ammonium Acetate
15. Ammonium Oxalate
16. Ammonium Sulfate, Purified and Reagent
17. Ammonium Thiosulfate
18. Boron Trifluoride, Gas and Various Complexes
19. Chromium Fluoride
20. Cuprous Chloride
21. Ferrous Ammonium Sulfate
22. Lead Nitrate
23. Potassium Acetate
24. Potassium Bifluoride
25. Potassium Borate, Tetra
26. Potassium Nitrite
27. Stannous Chloride

Clip this coupon to your letterhead and mail today!

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Please send me information on the following B&A Product(s). (Write in number and principal use:)

_____ _____

_____ _____

Name_____

Company_____

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City_____ Zone____ State_____

PL-12

Personals

Dave F. Seymour has been appointed to the technical service staff of the Metal Finishing Department of the L. H. Butcher Company, a subsidiary of the Udylite Corporation.

Seymour, a chemical engineer, having had five years of chemical and metallurgical engineering at the University of Minnesota, devoted time in welding rod and steel case production prior to developing interest in the metal finishing field. Diversified experiences in research as well as service was obtained through employment at the Promat Division and later as factory manager for the Pacific Coast Division of the Diversey Corporation of Chicago.

Seymour will devote his entire time to the sales and service of Enthone products for the Western area.

John M. Manypenny, former sales manager with the Harshaw Chemical Company's scientific division, has been named Eastern District Manager for Beckman Instrument, Inc., with headquarters at the company's new branch plant in Mountainside, N. J.

An electrical engineer with wide experience both in the scientific and industrial instrument fields, Manypenny served as sales manager with Harshaw for the past six years. Previously, he spent nine years with the Bristol Company in industrial sales and market research.

Dr. R. M. Lacy has been designated Technical Director, Michigan Chrome and Chemical Company, Detroit, Mich. Dr. Lacy is a graduate of the University of Oklahoma, where he earned his Ph.D. in chemistry and physics.

For the past ten years he has been with the General Electric Company, Major Appliance Division, Bridgeport, Conn., as Laboratory Manager.

Lacy

Dr. Lacy will be in charge of research and development work on vinyl plastisols and other synthetic coatings for the electroplating, wire goods, textile, automotive, and electrical equipment industries.

William J. Jancik has been named to the sales department, Daniels Plating Barrel & Supply Co., Newark, N. J., and will cover metropolitan New York and New Jersey.

Jancik

Jancik attended City College of New York and Newark College of Engineering. Previously he was in charge of metal finishing for the Burndy Engineering Co., New York City. He was also associated with the Aircraft Radio Corporation, Boonton, N. J.

FINISHING SPECIALIST

Thoroughly experienced in all phases of plating and plating shop operations invites inquiries from progressive expanding manufacturer for opportunity to grow with organization. Degree plus 15 years practical experience in management, administrative engineering, layout, development, processes and specifications. Capable of installation and operation of entire plant or department. Presently plant manager. Age 39. Salary commensurate to responsibility. *Reply to:*

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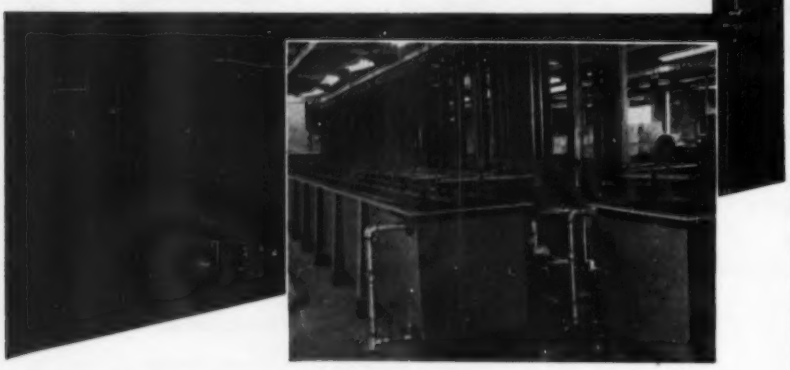
445 Broad St., Newark 2, N. J.

LONGER LIFE—MORE PROTECTION



Manhattan Rubber Linings

For complete protection against contamination of plating solutions, and for tanks that will withstand heavy duty corrosive service, manufacturers specify "Manhattan Rubber Linings."

As a result of over half a century of experience in meeting the needs of equipment manufacturers, Manhattan has developed the most dependable and economical rubber linings in the industry today. Made of calendered sheets in required thickness of non-porous natural or synthetic rubber, these linings eliminate plating "risks" and give longer, better service. In some cases, Manhattan Rubber Lined Tanks have been reported in continual use for over 25 years.

To detect any imperfections which might allow acid to penetrate the rubber, Manhattan Lined Tanks are tested dielectrically under 15,000 volts. Made to withstand the severest conditions of use, Manhattan Rubber Linings are compounded with an exclusive inseparable rubber-to-metal bond.

Depend on Manhattan's experience and leadership in rubber engineering. Specify "Manhattan Rubber Linings" to meet your most rigid requirements.

RUBBER LINING PLANTS AT PASSAIC, N. J. AND NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles • Teflon Products • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

It all adds up!

+ Long-time service —
"Custom-Built" Selenium stacks are hand-assembled from matched, pre-tested selenium plates. Have no 'weak spots' where failures can start. All components are protected against heat and corrosion, and have practically unlimited life.

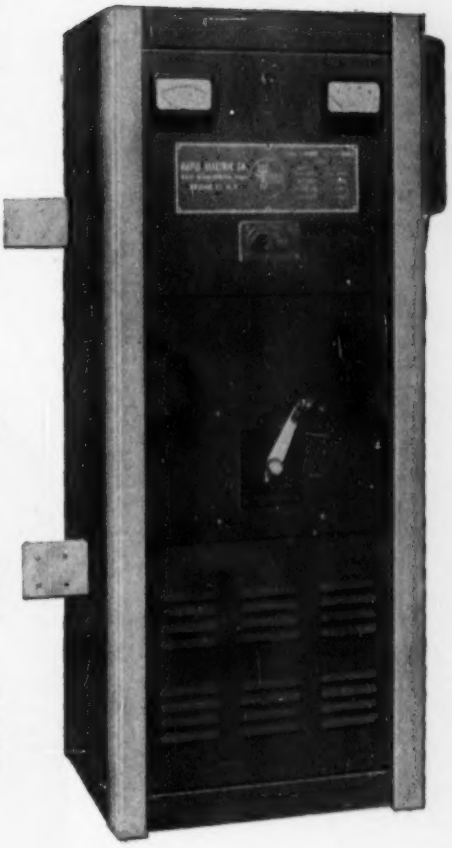
+ High efficiency —
"Custom-Built" stacks and the heavy-duty transformer combine to deliver DC power at high efficiency, eliminate unnecessarily prolonged runs, save on power bills.

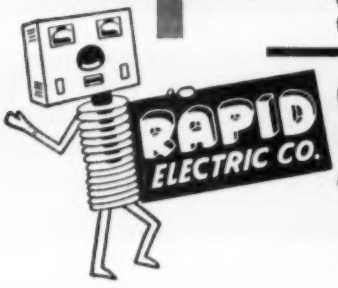
+ No loss of efficiency due to overheating —
Effective updraft-type cooling system permits full-load operation even at room temperatures up to 110°F.

+ No lost time due to burnouts —
Oversize copper bus throughout to handle normal overloads. Built-in "three-way" automatic protection guards against dangerous overloads.

+ No supervision needed —
Connect to AC line and DC bus, set the convenient, one-knob output control, then touch the button on the electromagnetic starter — that's all there is to operating it.

+ No maintenance needed —
Only moving parts are in heavy-duty totally enclosed fan motor.



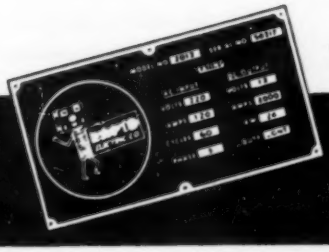


SELENIUM RECTIFIERS

Your Best Source of DC Power

Rapid Electric Selenium Rectifiers are available in bench models and in floor models ranging in size up to 250 KW — DC output capacity, with four types of controls: (1) as a basic model (for fixed voltages), (2) with half-controls (for the upper half of the range only), (3) with full controls (for the entire range) and (4) with remote full controls.

Catalog K is available, giving full details.



THE NAMEPLATE THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY

2893 Middletown Road • New York 61, N. Y. • Phone TALmadge 8-2200

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"GENTLEMEN, WE MUST CONSIDER OVERALL COST, TOO!

"THESE FACTS AND FIGURES PROVE THAT THE NEW CHANDEYSSON MOTOR-GENERATOR, FOR PLATING OR ANODIZING, COSTS LESS THAN OTHER POWER CONVERSION METHODS" - -

Higher Efficiency— CONSUMES LESS POWER

The NEW 5,000 amp. 12 volt Chandeysson Motor-Generator, with an *overall* power efficiency of 85% plus, may save upwards from $800.00 a year in power consumption alone, or $9,600.00 in the *first twelve years of its operation**, when compared to units of similar rating used in other power conversion methods. In *overall* cost, the Chandeysson Generator is less . . . in *overall* power efficiency, the Chandeysson Generator is greater!

**Based on power rate of 1¢ per kilowatt hour.*

Better Power Factor — HIGHER PLANT EFFICIENCY

The Chandeysson Synchronous Motor, with a built-in 80% leading or unity power factor, assures you of a remarkably high degree of efficiency. By improving the overall plant power factor from 80% lagging to 90% lagging through installation of a synchronous motor, the NEW Chandeysson Generator will reduce the shop current as much as 11% for the same kilowatt load all along the line! You'll save on power bills and reduce transformer and feeder losses throughout the entire plant!

Tailored Design & Construction — A LIFE-TIME OF SERVICE

The Chandeysson Motor-Generator, especially designed for the Electrolytic Industry, operates at *peak* efficiency for years and years even under the most adverse conditions. There are Chandeysson Units still in constant use after forty-eight years of service! The Chandeysson Generator will pay for itself over and over again and, regardless of its age, always has a high resale value.

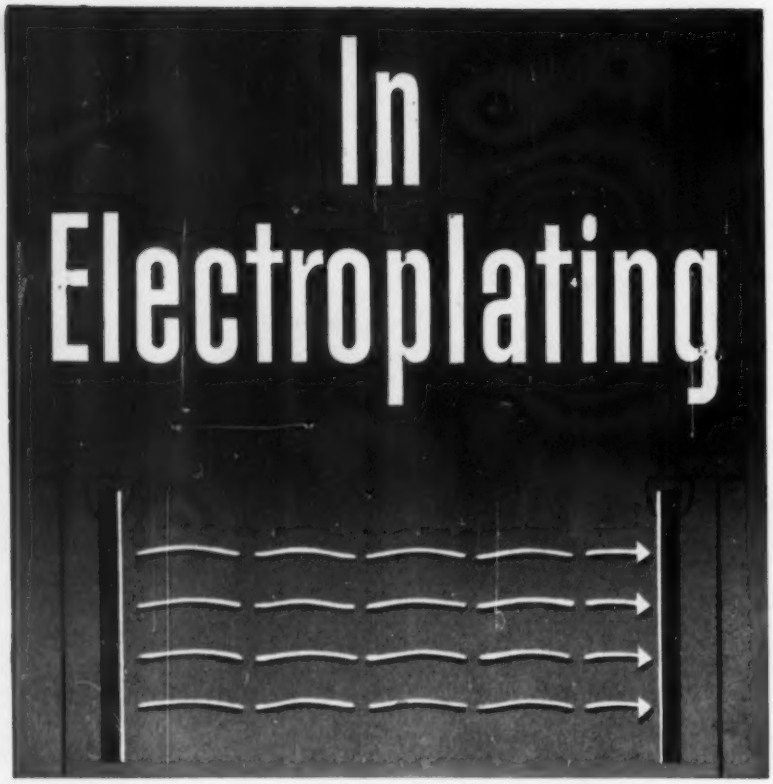
Higher Reserve Capacity —
WITHSTANDS GREATER OVERLOADS

Chandeysson Motor-Generators have been known to carry loads far in excess of rated capacity for long periods without damage to the unit. They can be counted on to deliver a steady flow of current through intermittent high overloads without the risk of harming the unit or spoiling the work in the tank. Like the Chandeysson name, the Chandeysson Motor-Generator is something you can depend upon!

IT WILL PAY YOU TO INVESTIGATE THE STORY OF THE NEW CHANDEYSSON MOTOR-GENERATOR — WRITE FOR BULLETIN D101; NO OBLIGATION OF COURSE.

Chandeysson ELECTRIC COMPANY
4078 Bingham Avenue
St. Louis 16, Missouri

B54



...you'll want Koppers Potassium Cyanide Solution

• Koppers offers Potassium Cyanide in easy-to-handle liquid form. This time- and work-saving solution combines with copper cyanide, zinc cyanide, cadmium and silver cyanides to form a complex salt that is soluble in water.

Solid granules of Potassium Cyanide presently being used in the electroplating process require a dissolving period which, in turn, involves extra time and effort, and results in higher expenditures. Koppers economical, ready-to-use solution requires no preparation, whatsoever.

Potassium Cyanide is widely used in the copper plating of automobile parts, such as bumpers, door handles, and grilles, where copper is used as a base coat for chromium plating.

Koppers Potassium Cyanide is available in 55-gallon drums. Its lower price structure and its easy-to-use liquid form make it especially desirable. For further information, write:

KOPPERS ®

Koppers Chemicals

KOPPERS COMPANY, INC.
Chemical Division, Dept. P-123,
Pittsburgh 19, Pennsylvania

Personals

Tom Richards has been named representative in the Cincinnati, Ohio territory for Allied Research Sales Corporation, a subsidiary of Allied Research Products, Inc.

Richards

Richards' headquarters will be at 426 Transportation Bldg., Cincinnati. From that location he will serve manufacturers in the Southern Ohio-Indiana-Northern Kentucky area.

Robert C. Trees has been named to the newly created post of director of advertising, sales promotion and market research for the Udylite Corporation.

Trees was formerly advertising manager and chief estimator for the corporation.

Trees **Reynolds**

A graduate of Columbia University, he held executive positions in varied manufacturing fields prior to joining Udylite in 1943.

Also announced was the appointment of **Russell E. Reynolds** as sales engineer.

Reynolds has been in the process and quality control department of a large manufacturing firm and was formerly a research and production supervisor in the plating field. He was graduated from the University of Detroit with a B.S. in chemical engineering.

He will work in the Pennsylvania district, with headquarters at the Udylite Cleveland office.

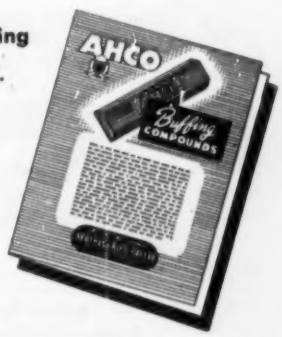
Frank Grilli, of Brooklyn, N. Y., whose entire career has been devoted to chemical sales work, has joined the New York Branch sales office staff of Diamond Alkali Company.

for EVERY buffing application...

AHCO
Buffing Compounds

All AHCO Buffing Compounds, including among others tripoli bars, white compounds, and rouges, are formulated of the finest grease binders and abrasives. No matter what surface finish you desire when buffing brass, copper, aluminum alloys, zinc base alloys, lead base alloys, or other non-ferrous alloys, there is one AHCO Compound, or combination of compounds, that's just right . . . for cutting down to an initial smoothness, for cutting down and coloring in a single operation, or for coloring to a high lustre. Like 99% Nucast Nickel Anodes, AHCOLOID Metal Cleaners, and other AHCO Compounds, AHCO Buffing Compounds are the work of experienced chemists. And every order is laboratory controlled for uniform high quality.

For full details about AHCO Buffing Compounds write for Bulletin B-7.



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APOTHECARIES HALL CO.

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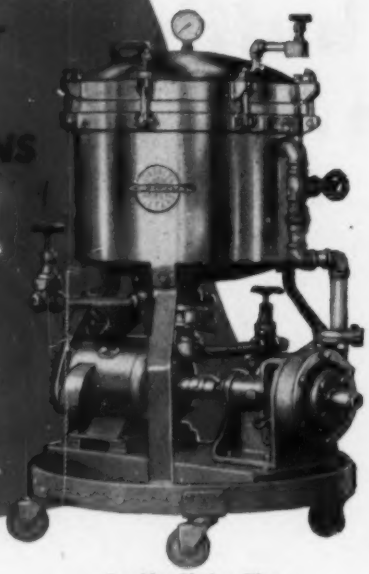
FOR LOW COST FILTERING OF PLATING SOLUTIONS

SPARKLER HORIZONTAL PLATE FILTERS



Sparkler Plating Filter
Model 18-D-6 Alliron
600 G.P.H. Portable

HERE'S HOW

★ On a horizontal filter plate it is possible to apply a thin pre-coat with about one-third the filter aid, and in one-third the time required for pre-coating a non rigid media or a surface in a vertical position. This saves time and filter aid.

★ With the Sparkler horizontal plate you can apply this thin pre-coat evenly over the entire plate surface and start filtering immediately with less pressure and obtain maximum consistant clarity right from the start up to the end of the cycle.

★ A filter cake on a horizontal plate will not crack, slip or fall off even with varying pressure or a complete shut-down of the filter. No pre-coat renewal is ever required after an interruption in operation.

★ When it is necessary to clean the filter, the Sparkler filter tank can be emptied in a matter of minutes with a minimum of loss of valuable plating solution.

★ Any grade of filter paper from fine to coarse can be used in a Sparkler filter. This makes it ideal for carbon treatment of solutions. Carbon mixed with water in a stand-by tank is circulated through a clean set of filter paper on the plates until a carbon cake is formed. The solution requiring carbon treatment is then circulated through the carbon beds without contaminating the plating tank or a shutdown of plating operations.

★ At the end of the cycle with a Sparkler filter you can blow-down with air and produce a relatively dry cake that can be disposed of in a trash can rather than washing it down the drain with attendant sewer clogging problems.

★ You will find your Sparkler plating filter positive and dependable from a standpoint of uniform high quality filtering and economical in labor and material.

SPARKLER

Sparkler representatives in all principal cities are ready to give you personal service on your filtering problems, and show how you can make a material saving in operating cost.

MANUFACTURING COMPANY
Mundelein, Illinois

Sparkler International Ltd.
Prinsengracht 876, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill. U.S.A.

Personals

Active for many years with Innis, Speiden & Co., of New York, importers, exporters and manufacturers' agents of industrial chemicals, colors and allied products, Grilli was most recently manager of their resale chemical department. He will be located at Diamond's New York office, 122 E. 42nd St.

He completed the chemistry course at Pratt Institute, and followed with courses in business administration at Alexander Hamilton Institute and special courses at Columbia University.

Lee Watkins, Director of Sales for the Almco Supersheen Division of Queen Stove Works, Inc., and well-known au-

Watkins

thority on barrel finishing, was the principal speaker at the Utica, N. Y., chapter of the American Society of Tool Engineers. Mr. Watkins also gave an address in Syracuse, N. Y., to engineers and other personnel of the General Electric Corporation of that city.

Dr. Otto Kardos has been appointed to the post of chief research electrochemist by Hanson-Van Winkle-Munning Co.

He has been associated with the H-VW-M

Kardos

Hart

organization for nine years. After receiving his Ph.D. from the University of Vienna, he worked as an electrochemist in Austria, and was later an electroplating consultant in France for four years.

Also announced was the appointment of **John S. Hart** as field electrochemist. Working out of the Detroit office, he will troubleshoot and service customer plating installations in Michigan and Ohio.

Hart, in the metal finishing field for the past 14 years, leaves Oakman Plating

USE "RELIANCE" PRODUCTS FOR

ECONOMY : EFFICIENCY : DEPENDABILITY

LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT

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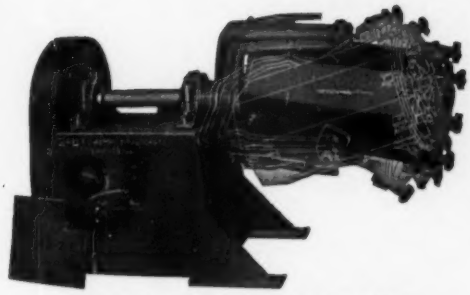
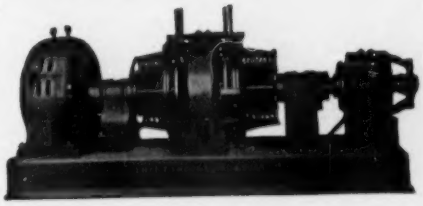
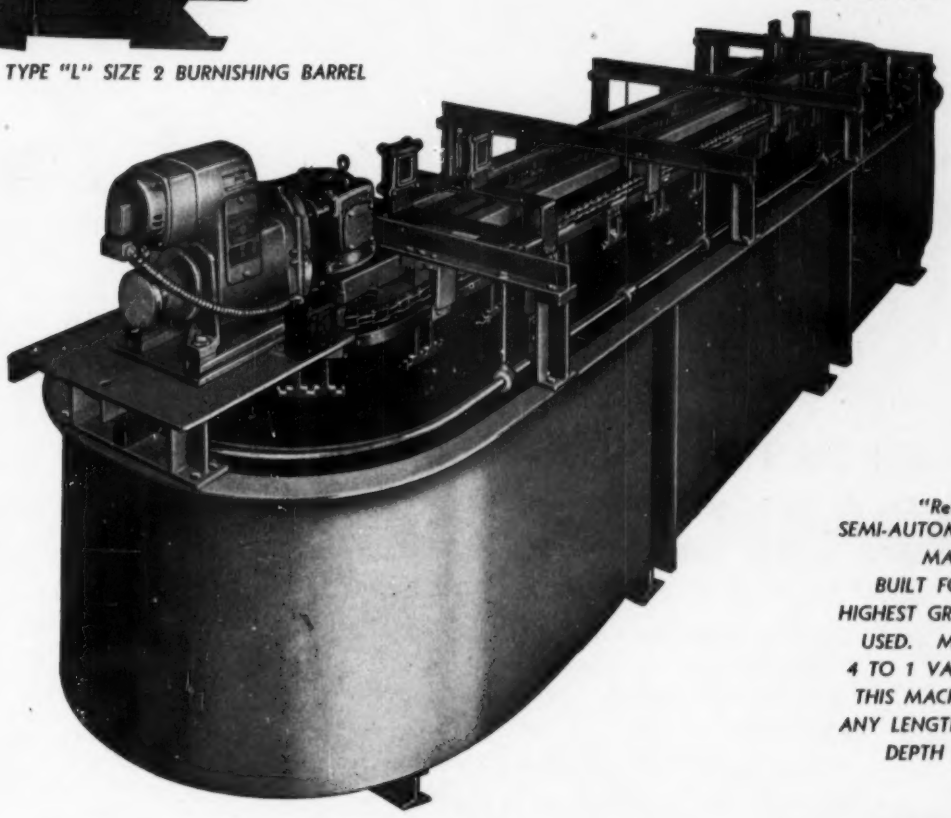


TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



"Reliance" SEMI-AUTOMATIC PLATING MACHINE BUILT FOR SERVICE HIGHEST GRADE MATERIAL USED. MOTOR ½ HP 4 TO 1 VARIABLE SPEED. THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

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Complete Plating Plants Furnished

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1426.

Personals

Co., Detroit, where he was general manager. He formerly worked for National Plated Products as works manager, and Chrysler Corp., Engineering Division, as a plating engineer.

Author of two articles on silver plating aircraft bearings, he is a graduate of Michigan State College, B.S., 1939, and Chrysler Institute of Engineering, M.A., 1941.

The appointment of **Walter R. Lockwood** as district manager of the Indiana-Kentucky and Tennessee territory also was made. Assisting him will be **Richard Marshall**, who has been newly appointed to cover Kentucky and Tennessee, along with a part of southern Indiana.

Lockwood, whose headquarters will remain in Anderson, Ind., will continue his

Lockwood Marshall

direct sales responsibilities in the rest of Indiana. With the company for 20 years, he has worked in this territory for the past 13 years. He attended Rutgers University, and is a member of the AES Indianapolis Branch.

Marshall, whose headquarters will be in Louisville, has just completed a two-year training program at the company's main office and laboratory. A member of the AES, he came to H-VW-M from the plating laboratory of National Cash Register Co., Dayton, Ohio. He is a graduate of Michigan State College, B.S. in chemistry, 1948.

Dr. William F. Waldeck was promoted to the post of director of research and development by Wyandotte Chemicals Corporation.

Wolcott

Dr. Waldeck succeeds **Dr. Thomas H. Vaughn,** who left to become vice-president in charge of research and development of Colgate-Palmolive-Peet Co.

A native of New York City, and a chemical engineering graduate and recipient of a doctorate in chemistry from New York University, Dr. Waldeck came to Wyandotte in 1939 from the Columbia Chemical Division of Pittsburgh Plate Glass Company, where he was acting director of research.

He has served Wyandotte as assistant director of technical service, assistant director of research and director of chemical research.

Election of **Frank B. Wolcott** as vice-president in charge of manufacturing of Wyandotte Chemicals Corporation also was announced.

Wolcott has been general manager of manufacturing for the company. A native of Cleveland, Ohio, he obtained his engineering degree at Princeton in 1930. He joined the New Jersey Zinc Company where he was in charge of slab zinc and metal manufacturing and, subsequently, plant superintendent. He joined Wyandotte in January, 1951.

W. Alexander McCune, Jr., has been appointed general sales manager of Norton Company of Canada, Ltd. A former abrasive engineer in the northern New Jersey area, McCune assumed his new duties in November, succeeding **C. W. Fell,** who became abrasive engineer in the Toronto area.

Winton A. Vagedes has been appointed an abrasive engineer and will assume McCune's former territory. He is a former

after the first call we generally have a steady customer for our

EXTRA HIGH QUALITY 99.7+% PURE

CHROMIC ACID

TECHNICAL GRADE—FLAKE

Only a few years ago we were new comers to the Chromic Acid business. Since then we've shipped quite a few million pounds . . . and made a lot of good friends, too.

We think you will like the quality of our products and the fair way we do business. Why not send us a modest order and judge for yourself? That's the simple way our present customers got started with BFC Chromic Acid.

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avoid stream pollution due to chromium waste...

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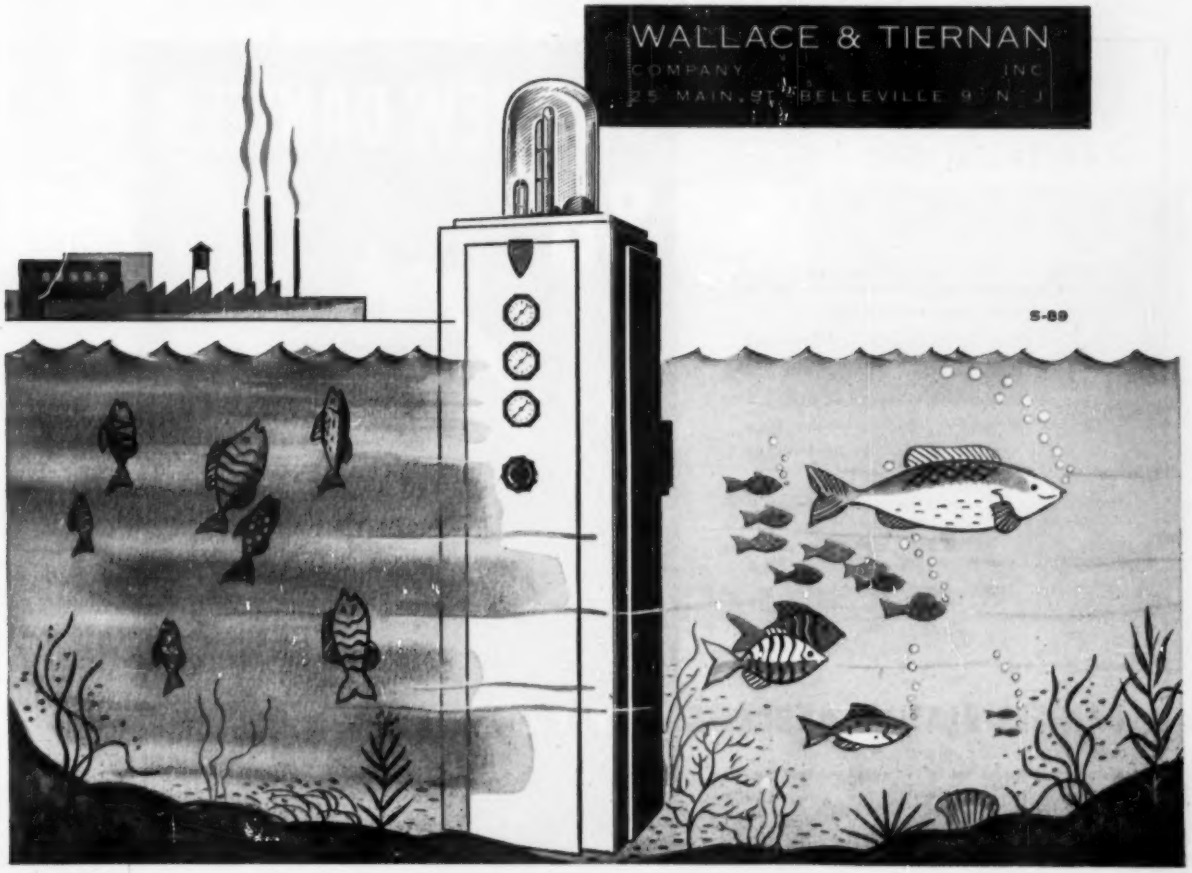
With the proper treatment equipment, toxic hexavalent chromium can be reduced by sulphur dioxide to the trivalent form and then completely precipitated by alkali for standard removal to a disposal area — such as a lagoon. After this treatment the waste water can be drawn off and safely disposed of in the usual manner. This treatment is in full compliance with most local and state pollution abatement laws.

Wallace & Tiernan offers the heat treating and metal finishing industries several types of Sulphur Dioxide Feeders with optional controls for manual, semi-automatic or fully automatic operation. These feeders are adaptable to either the "batch" or "flow-thru" methods of treatment in both large and small plants.

Similar equipment is also available for the destruction of cyanide waste by alkaline chlorination.

W&T offers PROVEN EQUIPMENT — hundreds of similar units are serving industry today, EXPERIENCE — over forty years of building chemical feeding equipment, and SERVICE — field representatives are located in principal cities throughout the country.

Write today for additional information on W&T Sulphur Dioxide Feeders and Alkaline Chlorination Equipment, at no obligation to you, of course.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1428.

Personals

department manager and abrasive specialist at the C. W. Marwedel Co. in San Francisco, a Norton distributor.

McCune has been with Norton since 1940. A graduate of Dickinson College, he is a member of the American Society of Tool Engineers and American Society of Carbide Engineers.

William H. Murphy, formerly Chicago North Side territorial representative, has been appointed District Manager of the

Murphy

Metal Industries Department, the Diversey Corporation. He will supervise the sales of pre-finishing cleaners and etchers to customers in Illinois, Wisconsin and Missouri.

Murphy has been with Diversey since February of 1949. He is an active member of the AES. Chicago Branch, and is a graduate of Notre Dame University.

John E. Caskey has been elected a vice-president of United States Rubber Co. and general manager of the company's Naugatuck Chemical division.

At the same time, it was announced that **George R. Vila,** formerly general sales manager of Naugatuck Chemical division, will become assistant general manager of the division.

Caskey and Vila will direct all sales, research and production activities of the division which is the largest manufacturer of rubber chemicals in the nation. It is the third largest producer of polyvinyl chloride resins and a major producer of polyester resins for many structural uses.

Leroy J. Wieschaus has been designated district manager of the Birmingham sales office of the American Wheelabrator & Equipment Corp., Mishawaka, Ind.

Wieschaus, a registered professional engineer, has been in the home office of the company for more than seven years, holding the positions of market research engineer, assistant sales promotion manager, and most recently, abrasive engineer.

Obituary

✣ **Edward Milburn Stephenson,** the oldest member of the Hartford Branch AES, passed away on October 12, 1953 at the age of 84. Mr. Stephenson was an honorary member of the Society and was well known in the finishing industry.

He was a gifted silhouette artist and a collector of curios. He sold lacquer to industrial plants throughout New England for many years; was a pioneer in the uses of lacquer in the textile industry and initiated its use in the waterproofing of straw hats.

Stephenson's hobby was cutting silhouettes of animal and woodland scenes. His work has been on exhibition at the Hartford Public Library in past years. He began cutting silhouettes at the age of eight and his art was characterized by three dimensional effects.

Stephenson owned an extensive curio collection which his father began in England. His collection embraced rare colonial teapots of American, English and German design, some 50,000 sea shells, a Roman loving cup and lamp from the ruins of Pompeii, and other rare antiques.

Stephenson gave most of his collection to the Children's Museum of Hartford and other museums four years ago.

He was born in Hull, England, coming to this country 62 years ago. Besides his wife, Mrs. Marie Liddell Stephenson, he leaves three sons, Malcolm of New York, Edward L. of West Hartford, and William Stephenson of New York.

THE NEW DANIELS 8H

Daniels presents the radically new 8H Plating Barrel with these innovations:

- New Cylinder Arm and Arm-lock
- New Materials and Modern Design
- New rubber-covered Contact Frame
- Three Cylinders to choose from — Bakelite, Rubber or high-temperature Lucite

Designed to fill the demand for a small barrel for efficient plating of small lots of bulk parts, the 8H is ideally suited for precious metal plating, laboratory work and as a supplement to the production plating plant.

DANIELS PLATING BARREL & SUPPLY CO.

MANUFACTURERS & DISTRIBUTORS
Electroplating and Polishing Equipment and Supplies

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MArket 3-7450

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DANIELS

Rotating Cathode Boosts Chrome Plating Up To 5700 Pieces Hourly!

LASALCO'S

Circular Chrome Plater

Lasalco's latest chrome plater with its continuously moving cathode offers some extraordinary cost-cutting and time-saving possibilities for increasing your output of pieces up to 3" long. Here are just a few of its many advantages:

- **One-man loading**
- **Fully automatic unloading**
- **No racks or rack upkeep**
- **Easily raised driving mechanism and cathode wheel gives quick access to coils and anodes. Any parts dropping into tank can be easily, instantly recovered.**
- **Unusually high production—5,733 pieces per hour at 13 seconds; 4,188 pieces hourly at 18 seconds; 2,635 pieces at 29 seconds. Minimum output, 420 pieces at 3 minutes.**
- **Machine is delivered complete, ready to install, and requires only necessary electrical connections and exhaust duct.**

Lasalco's Circular Chrome Plater can be a real profit builder. Write immediately for all the details.

SPECIFICATIONS

Cathode Wheel Diameter 30"; 31 Fingers, 3" Centers
Effective Plating Travel 68.4"; No-plate Travel 25.8"
Anode Rods 24" I.D.; 36" O.D.; ½" Diameter
Center of Anode to Cathode Center 4"
Anodes, Flat 6% Antimonial Lead ¼" x 6", Three 26" Long; Two 24" Long; Two 2" Long; One 5" Long
Tank Diameter 54"; Depth 14"
Solution Capacity 115 Gals., 2" From Top
Heating: ¾" I.D. 6% Antimony Lead Steam Coil
Drive: ¼ H.P., A.C. Motor; Variable Speed Reduction

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Trade Literature

L—1200. Lead Anodes for Chromium Plating—A 4-page folder designed to help the plater obtain lead anodes which will best suit his specific needs for use in chromium plating has been issued by Heil Process Equipment Corporation, 12902 Elmwood Ave., Cleveland 11, Ohio.

Sufficient anode thickness required for good current distribution and to avoid overheating is assured by the various standard anode styles available. Information regarding special shape lead anodes is also indicated in the bulletin. A pictorial description is included of the wide range of hook types which are skillfully homogeneously bonded to the anode by expert lead burners. Availability of any style lead anode in 6 per cent antimony, 4 per cent tin, 7 per cent tin and other lead alloys is noted. For your copy of this descriptive folder use Reader Service Card.

L—1201. Buyer's Guide of Testing Instruments—A buyer's guide on electric testing instruments has been announced as available from the General Electric Company, Schenectady 5, N. Y.

The new 16-page bulletin, designated GEA-5469B, provides data on such instruments as hook-on volt-ammeters, hook-on wattmeters, hook-on power-factor meters, portable recorders, voltmeters and ammeters, phase-sequence indicators, hand pyrometers, surface roughness scales, insulation-resistance meters, and others.

Application data, features of each instrument, and prices are included. For your copy of the guide, use Reader Service Card.

L—1202. Automatic Recording Spectrophotometer—A new robot spectrophotometer, which runs analyses practically unattended and with accuracies matching or exceeding the best manual operation, has just been announced by Beckman Instruments, Inc., South Pasadena 1, Calif.

Under test since completion of the original design in 1951, the instrument was operated for several thousand delegates at the Ohio State University Symposium on Molecular Structure and Spectroscopy last June. It was also exhibited in September at the Instrument Society of America show in Chicago.

Data File R-58-72 provides further information on the Model DR Spectrophotometer. For your copy, use Reader Service Card.

L—1203. Facts About Silicon Carbide—Since its discovery in 1891 by Edward Goodrich Acheson, silicon carbide has been generally known for its widespread use as an abrasive. Available for use as loose grain and in the form of bonded and coated abrasive products, silicon carbide is capable of grinding and polishing a wide range of metallic and nonmetallic materials.

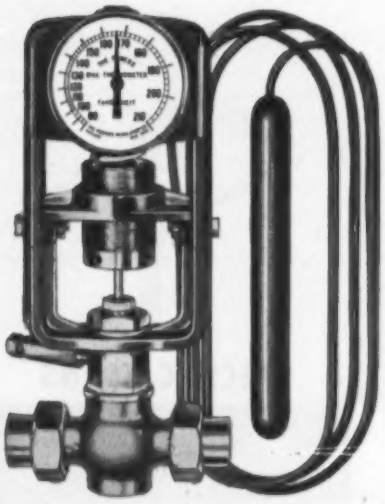
In addition to its abrasive applications, however, silicon carbide also possesses some unusual physical and chemical properties, and is finding increasing use in the manufacture of a number of other completely different types of products. A new 52-page brochure issued by the Carborundum Co., Niagara Falls, N. Y., discloses the properties of silicon carbide as related to these applications and outlines manufacturing techniques. An extensive bibliography is also given. For your copy of the brochure, use Reader Service Card.

L—1204. Abrasive Belt Grinding and Finishing—A new 12-page, illustrated brochure—"The 3M Method of Belt Grinding and Finishing"—has been announced by the Minnesota Mining and Manufacturing Co., 900P Fauquier St., St. Paul 6, Minn.

The booklet describes the 3M method, using coated abrasive belts, as a high-speed means of grinding and finishing flat or contoured surfaces of all kinds of metal ranging from soft brass to super hard tungsten carbide, as well as glass, plastics, ceramics and hard rubber.

It illustrates, by means of photographs and drawings, eight abrasive belt machines for a wide range of typical grinding applications in operations ranging from those of the small shop to the large factory.

Also included are typical case histories



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For
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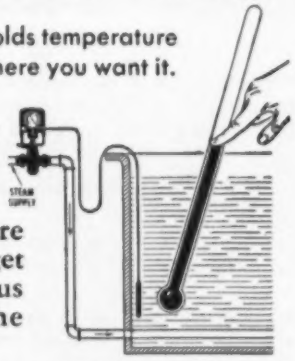
Holds temperature where you want it.



Saves LABOR and Steam
Helps Eliminate Costly Rejects

Powers No. 11-MF Regulators are self-operating. They will help you get the most effective use from various solutions by holding them at the right temperature automatically.

Plastic Covered Thermal Bulb and Tubing—is highly resistant to solutions in above processes. Prevents electrical shorts. No insulators required for the regulator.

Easy to Read 4" Dial Thermometer—indicates temperature of liquid being controlled and makes it easy to adjust regulator for different temperatures.

Bulletin 330 describes this simple, dependable control. May we send you a copy? (b31)

THE POWERS REGULATOR CO., SKOKIE, ILL.
Offices in over 50 Cities, see your Phone Book • Established in 1891

UNICHROME
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News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

This Equipment Helps Cut Finishing Costs

A better finish ...and a saving, too

Plating golf club heads in the Unichrome SRHS Chromium Bath has made a distinct difference to one plant. There is less "burning" and therefore fewer rejects. The finish is brighter. Current consumption is less, which saves power costs. These results are due to the wider bright plate range and higher cathode efficiency of the SRHS Bath. Bulletin gives full facts.

PRACTICAL PAINTING FOR PLATING PLANTS

Painting with ordinary paints doesn't pay off in plating shops. Protecting with Ucilon* Coating Systems *does*. These coatings really withstand the chemical solutions and high humidity. At one plant, for instance, they have given more than 3 years' service on tanks, ducts and walls. Such coatings can obviously lengthen life of equipment, increase time between paint jobs, keep a plant looking better to encourage better work.

*Trade Mark

Insulations now made for temporary or long use

Platers can now practically choose a "custom" insulating material for the job on hand. Stopping off for plating, being a temporary application, is best handled by one of the Unichrome Stop-off Lacquers or Compounds. These are easy to apply, easy to remove once the work is plated. For permanent installations, on composite racks, conforming anodes and tank grids, solid Unichrome rods, tubing, and sheets offer the needed durability. For insulating working "tools," such as racks, Unichrome Coating 218X proves best. Specific data on each available.

UNITED CHROMIUM, INCORPORATED
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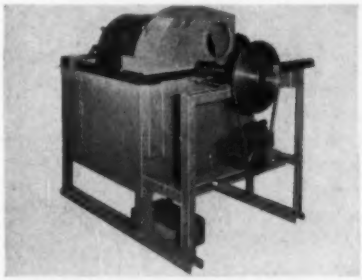
In Canada:
United Chromium Limited, Toronto, Ont.

United Chromium applies 25-year working knowledge of plating to provide equipment for lower operating expenses

IMPROVED plating processes and coatings go a long way toward assuring the best possible finish at the lowest cost. However, equipment, too, affects results and profits. An inefficient or insufficient current supply gives trouble. Breakdowns in heating or cooling elements snarl production. Anode design affects costs and quality, too.

Realizing this, United Chromium has taken the next step in contributing to finishing department efficiency. Now, in addition to the widely used Unichrome Plating Processes and Unichrome Organic Coatings which supplement them, several specialized types of Unichrome equipment are being made available. Already in service in many plants, they are proving their ability to help reduce costs.



CHROMIUM PLATING 500,000 PARTS

The Unichrome Chromium Plating Barrel answers at last the problem of chromium plating small parts without prohibitive handling expense. It successfully plates whole batches at a time. Output soars wherever it's being used. At one plant, for example, 500,000 small parts were plated by *one* barrel, in *one* day, by *one* operator.

HEAT EXCHANGERS THAT SELDOM NEED EXCHANGING

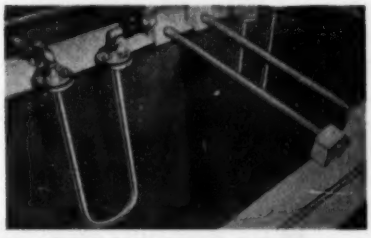
Unichrome Tantalum Heat Exchangers, the shell and tube type, have tantalum internal tubes. These tubes maintain heat transfer efficiency, lengthen equipment life in acid solutions, reduce maintenance to an absolute minimum. Result: Lower operating costs.

RECTIFIER WITH OVERLOAD CAPACITY

The line of Unichrome Selenium Rectifiers is complete . . . includes models to meet all plating and anodizing requirements. Self-contained units with built-in meters and controls, basic rectifiers with remote control, water-cooled models for extra protection against corrosion, saturable core reactors for stepless automatic regulation of current or voltage are all available. The Unichrome Extra Heavy Duty Selenium Rectifier carries the same guarantee as a motor generator set – to operate *continuously* at full load and at a 25% overload for two hours. All Unichrome Rectifiers provide full wave rectification with D.C. output that has less than 5% ripple.

ANODES WITH LONG ACTIVE LIFE

The right anodes for chromium plating are those designed to give good current distribution and no overheating; that provide good contact even on caked anode bars; that withstand the action of chromic acid baths during both idle and active periods. Unichrome tin-lead alloy anodes, designed with exactly these features, deliver unusual service.



HEAT COILS PAID FOR THEMSELVES

Made from acidproof metal, Unichrome Tantalum Heating Coils are working wonders in reducing maintenance costs. One plant installed 2 tantalum coils in their chromium plating tank, and took stock a year later. They found that the coils had already paid for themselves both in savings on usual repairs on former coils, and in production normally lost during the downtime. Every additional year of service—many of which are expected—will pay a bonus.

★ ★ ★

Bulletins with more information available – write or phone us.

Trade Literature

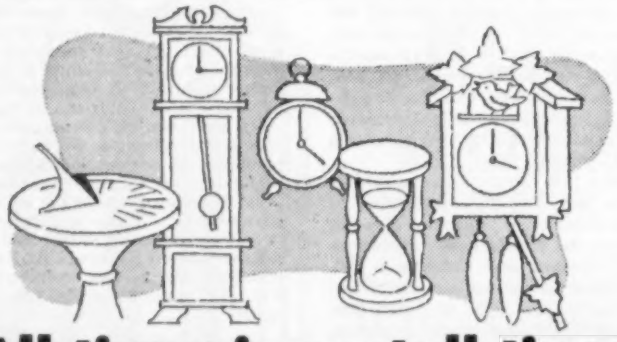
citing examples of significant savings in unit costs and greatly increased production where the 3M abrasive belt method has been adopted. For your copy of this brochure use Reader Service Card.

L—1205. Hand and Electric Hoisting Equipment Booklet—Hand and electric hoisting equipment is described in a bulletin published by the Yale Materials Handling Division, The Yale & Towne Manufacturing Company, Philadelphia 15, Pa.

Titled "There's a Yale Hoist for Every Lifting Job", the 12-page booklet illustrates the most suitable hoist for the big job, the specialized job, the occasional job and every job. Other illustrations show how hoists save time, money and manpower in various industries. For your copy of the bulletin, use Reader Service Card.

L—1206. Bulletin on Use of Peroxygens for Bright Dips, Metal Cleaning, Passivating and Inhibiting—New and improved methods of treating metal surfaces with peroxygen compounds are described in bulletin No. 51 published by the Buffalo Electro-Chemical Company, Inc., Buffalo 7, N. Y. The new publication is based on additional research and development that has occurred since bulletin No. 39 on the same subject appeared last year.

The types of surface treatments discussed include bright dips, cleaning solutions, passivation and inhibitors. Metals involved in the tests and investigations reported are: steel, aluminum, brass, silver and stainless steel. For your copy of the bulletin, use Reader Service Card.



All timepieces tell time!

Time is an important element especially when it involves cleaning, stripping, coating or other prefinish operations. Time is important as an element in quality and in cost.

Difficulty in attaining the result you seek may be a matter of timing only. Klem Engineers will not only specify the proper chemical for your job, but steer you in proper application, timing, temperatures, concentrations, etc. The extensive experience of this organization and lab facilities for exactly duplicating your conditions make possible more accurate analysis and recommendations.

3 OF 20 STANDARD KLEM PRODUCTS

MINIT KOTE—Cleans, neutralizes, phosphatizes ferrous metals and aluminum surfaces in 60 seconds for better paint adhesion.

BRITE KOTE No. 80—Protective dip before storage of copper and brass, removes all oxides and stains—an excellent protection from further corrosion.

KLEM KLEANER No. 167-PG—Still or soak tank cleaner for non-ferrous metals. Economical, efficient—will safely remove normal types of soil.

KLEM PRODUCT of the MONTH

KLEM KOTE

Cleans and conditions iron, steel and aluminum surfaces, imparts a fine phosphate coating on metal surfaces for better paint adhesion. KLEM KOTE is non-toxic, non-inflammable, requires no special handling precautions. Write for details.

KLEM Chemicals Inc.
14401 LANSON . . . DEARBORN, MICHIGAN

L—1207. Cleaning, Polishing, Plating Technical Bulletin—Chas. Pfizer & Co., Inc., 11P Bartlett St., Brooklyn 6, N. Y., have issued a 17-page technical bulletin, "Chemicals For Metal Finishing". Described in this release are various uses of citric acid, citrates, gluconic acid, oxalic acid, rochelle salt, and tartaric acid in cleaning, polishing, pickling, plating and phosphatizing. A bibliography of 100 references is included. For your copy of this helpful bulletin, use Reader Service Card.

L—1208. Conveyor Lubrication Data Sheet—How to automatically lubricate entire conveyor lines—trolley wheels, chains, drives, carriers and rollers—without stopping the line, thus eliminating shutdowns for lubrication, work spoilage and hazards of lubrication is illustrated in a new catalog sheet distributed by the Alemite division of Stewart-Warner Corporation, 1826P Diversey Pkwy., Chicago 14, Ill.

The utilization of Alemite's "big three" in industrial lubrication—conveyor trolley wheel lubricator, Accumeter centralized lubrication and Oil Mist all fully automatic—insures economic and dependable lubrication of entire lines.

The conveyor trolley wheel lubricator goes to work at the flick of a switch and lubricates every wheel on both sides of the track delivering an exact, measured amount of lubricant to each wheel. For your copy of the data sheet, use Reader Service Card.

L—1209. Filter Pumps—An 8-page bulletin issued by Sethco Mfg. Co., 74 Willoughby St., Brooklyn 1, N. Y., describes filter pumps and equipment. The booklet goes into the design and application of the corrosion resistant filter pumps; discusses solutions that can be filtered and the result of its operation. Photographs show the filter pump in action and a chart with various filter pump models, motor types and price is also included. For your copy, use Reader Service Card.

L—1210. Booklet on Cut-off Wheels—Norton Company, Worcester 6, Mass., announces a complete revision of its booklet, "Norton Cut-Off Wheels". While this is a revision, it contains much information which is completely new and up to date.

This 36-page instructive manual gives information on various types of cutting-off machines and abrasive cut-off wheels, their selection, application and proper usage; also photographs of typical cutting-off operations, and various helpful tables for wheel selection and conversion of wheel speeds to feet per minute values. This booklet may be obtained by using Reader Service Card.

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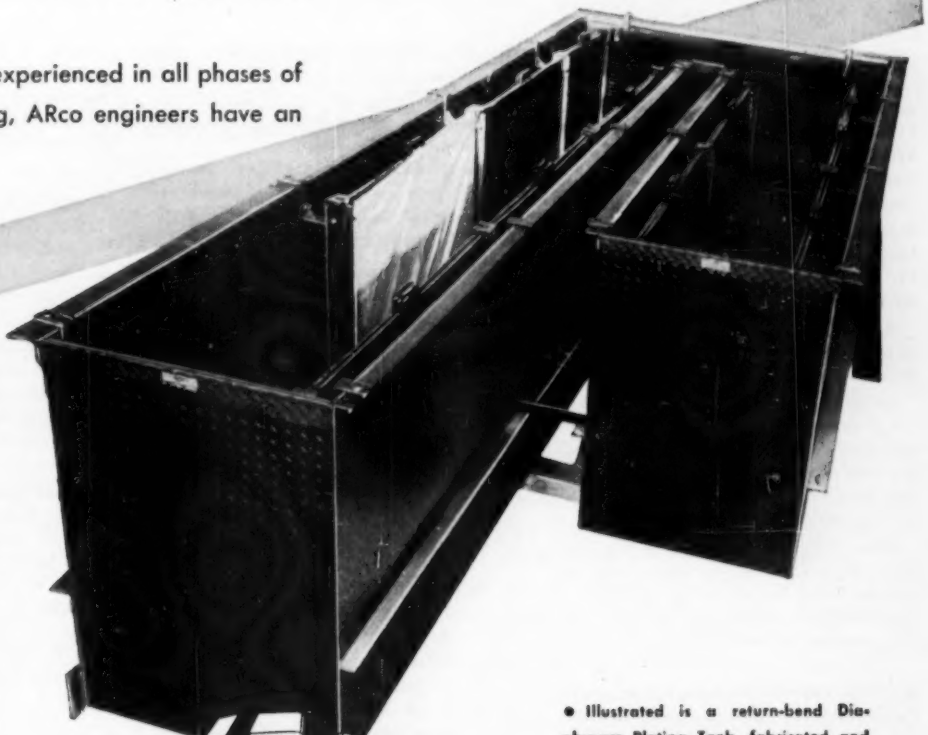
with DIAPHRAGM PLATING and ARco RUBBER LINED TANKS

● Providing for separate anode and cathode compartments, Diaphragm Plating Tanks, engineered by ARco . . . eliminate costly buffing due to roughness . . . prevent rejects due to thin spots . . . produce uniformly high plating quality.

Thoroughly experienced in all phases of electroplating, ARco engineers have an outstanding record of successful Diaphragm installations and conversions. They can help you achieve greater efficiency and higher quality production in your operations.



● Illustrated is a return-bend Diaphragm Plating Tank, fabricated and insulated by ARco.

SEND FOR THIS VALUABLE INFORMATION NOW . . . See the many ways in which you can reduce operational costs and improve electroplating production in quality and quantity.

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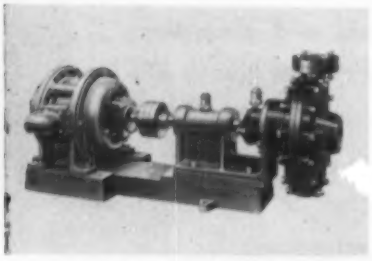
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1434.

Equipment and Supplies

E—1211. Hard Rubber and Buna "N" Pumps, Valves, Pipe, Fittings—Vanton Pump & Equipment Corp., Empire State Building, New York, N. Y., has announced a complete line of corrosion resistant process equipment including centrifugal pumps, valves, pipe and fittings manufactured in both natural and Buna "N" hard rubber.



The centrifugal pumps are available in an open impeller and a closed impeller type. Pump capacities range from 15 to 100 gpm with discharge heads up to 90 feet of water.

Globe, angle and wye valves in sizes from 1 to 4 inches are also available in both natural and Buna "N" hard rubber. For maximum strength all stems and discs are metal reinforced.

A complete line of hard rubber pipe and pipe fittings is offered as a complement to the line of pumps and valves.

Although the use of natural hard rubber is generally restricted to room temperatures or to temperatures not exceeding 120° F, the Vanton line is also available in special compounds which may be used to 180° F unsupported.

Buna "N" hard rubbers are considerably more resistant to heat and are recommended for service up to 225° F. For complete information on this new line, use Reader Service Card.

E—1212. Barrel Finishing Compounds Color Coded—Tumbling Sales & Service Company, Greenwich, Conn., announces that each product in their line of barrel finishing compounds is now furnished in its own distinctive color. Each color approximates as closely as possible the *p*H characteristics of the individual compound and serves as a rough guide as to whether the product is acid, neutral or alkaline.

This exclusive ESBEC feature is the first radical development in the field of tumbling compounds in recent years, and it brings to the tumbling room all the advantages of modern color identifications.

This new feature means: Easy, more positive identification, instruction, supervision; avoidance of wrong use and costly errors, and saving of time for both supervisors and operators. For more information on this new system, use Reader Service Card.

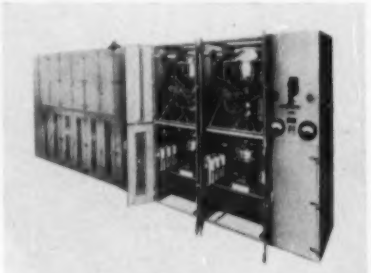
E—1213. TEFLON Impregnated Asbestos Packing—Industrial rod packings of braided asbestos, using an impregnation of 35 per cent Teflon are now being marketed by United States Rubber Co.

The new type of packing is expected to provide longer service than rod packings previously available because of its higher resistance to acids and alkalies.

The principal advantage of the resin for industrial packings is its high resistance to chemicals, including virtually all petroleum and coal tar solvents. It will perform satisfactorily in all temperatures ranging from minus 90 degrees F to plus 500 degrees. For more data on this new product, use Reader Service Card.

E—1214. Mercury Arc Rectifiers—The Richardson-Allen Corporation, 116-15P 15th Ave., College Point, N. Y., has developed and is now offering a complete line of mercury arc rectifiers.

These mercury arc rectifiers are air-cooled, pumpless, require no plumbing, are installed easily, and are designed for high efficiency and power factor.



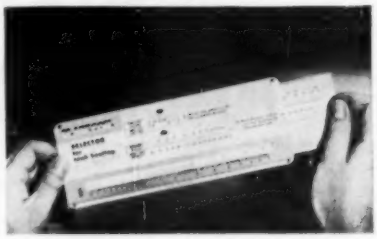
They are available up to 5000 kilowatts of dc power with a voltage range of 100 to 800 volts, and may be supplied with automatic or manual voltage control.

All are designed to operate on any ac input supply from 220 to 13,800 volts, three-phase, and 50/60 cycles as required. For more information on this equipment, use Reader Service Card.

E—1215. Glove Dryer—Used for drying rubber gloves. A dryer, made of aluminum throughout and provided with a drip pan and draining faucet, preserves rubber gloves for longer wear. The complete unit is mounted on a sturdy wooden base in mahogany finish.

For complete information write to: General Scientific Equipment Co., 2700P W. Huntingdon St., Philadelphia 32, Pa., or use Reader Service Card.

E—1216. Selector Chart—A new automatic sliding selector chart has been developed by the Platecoil Division of Tranter Manufacturing, Inc., to aid in calculating the number and type of Platecoils required in a tank installation.



By knowing the size of the tank in gallons or cubic feet, and the heating requirements, persons using the new chart can determine quickly the number of Btu's and square feet of Platecoil necessary to do the job efficiently and economically.

An added feature of the slide-chart is a handy C/D slide rule scale for ease in making calculations. The new device is constructed of 5-ply cardboard, coated for dirt and grease resistance. For more information use Reader Service Card.

E—1217. Cable Conveyor Line—The Cable-Link Corporation, 20175P John R St., Detroit 3, Mich., recently announced the development of cable conveyor systems under the Cable-Link trade name.

Based on the use of improved, plow steel cable, cut to 16, 24 and 32 inch lengths, with steel buttons swaged on both ends, these lengths of cable, thusly fabricated, are called "cable-links" by the manufacturer.

It is claimed that the service life of these conveyors is inestimable, since the systems have no moving parts below the rail and very few bearing points otherwise. Another longevity factor is the 0.02 friction ratio on which C-L systems operate, which is also reported to make these conveyors economical in power consumption. For more information on this equipment, use Reader Service Card.

E—1218. Chromatic Adhesive Release Coating—Applying the largest sizes of Brady markers is now "child's play" through the use of new **Blue Streak** release coating on Brady dispenser cards, according to W. H. Brady Co., 727P W. Glendale Ave., Milwaukee 12, Wis.

A new word . . . A-B-H-E-S-I-V-E . . . has been coined to describe the new release coating. *Ab*hesive (the opposite of *ad*hesive) describes a formula that prevents or decreases the tendency of simi-

To the Platers of America . . .

Season's Greetings!

THIS year, more than ever, America has many blessings for which to be grateful. May the New Year mark great progress among all nations toward world peace and unrestricted achievement of mankind.

We are grateful, too, for the progress in better plating methods by the plating industry—and the part ROHCO RESEARCH has been privileged to contribute to this advancement.

We thank our many friends and customers for their confidence and good will and pledge our continued efforts to even greater service in the coming New Year.

It is with great sincerity that we extend our wishes for a "Merry Christmas and a Happy New Year!"

ROHCO® PRODUCTS

NO-CRO-MIST® • ROHCO 303 STILL ZINC BRIGHTENER • ROHCO 100 BARREL ZINC BRIGHTENER • ZINC PURIFIER • ROHCO 20XL CADMIUM BRIGHTENER • RINS-AID • AIRCRAFT BLACK CADMIUM DIP • HULL CELL TEST SETS AND RECTIFIER UNITS • HANGING HULL CELL • HULL CELL AGITATOR • CURRENTESTER • ADDITION AGENT PUMP • FORCITE ANODE BASKET • CHROMETER

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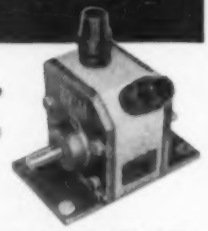
VANTON PUMP
TAMES
HARD-TO-HANDLE
CORROSIVE
CHEMICALS



* non-corrosive
* non-contaminating

POLYETHYLENE
***flex-i-liner* PUMPS**
designed specifically for corrosive and hazardous fluids

NO STUFFING BOXES, glands, shaft seals, gaskets or check valves. Fluid contacts only outer surface of durable precision molded flexible liner and inside of pump body block.

Select proper material and forget about corrosion or contamination.

Available in:
Body Blocks: Polythelene, Bakelite, Buna N Hard Rubber, unplasticized PVC, Stainless Steel. Flex-i-liners: Natural and pure gum rubber, Neoprene, Buna N, Hycar, Vinyl, Compar and Silicone.

CAPACITIES from fractional to 20 gpm . . . excellent for those hard to handle corrosive fluids and slurries. Illustrated booklet on request, as well as descriptive literature on corrosion resistant centrifugal pumps, valves, pipes and fittings.

VANTON
PUMP AND EQUIPMENT CORP.
EMPIRE STATE BLDG. • NEW YORK 1, N.Y.

Equipment and Supplies

lar or different materials to stick to each other.

The new chromatic *ab*hesive, applied to dispenser cards, has no effect whatsoever on any pressure sensitive adhesive. It permits instantaneous and practically effortless removal of Brady self-sticking products from the cards without distortion. For more data on this product, use Reader Service Card.

E—1219. New Heavy-Coated Abrasive Belt—Minnesota Mining and Manufacturing Co., 900P Fauquier St., St. Paul 6, Minn., has announced a new type heavy-coated abrasive belt to be sold under the trade name "Three-M-ite" Multicut cloth belt.

Combining the polishing characteristics of hand-coated glue and grain set-up wheels and belts, the new 3M belt offers all the advantages of a coated abrasive belt manufactured under controlled factory conditions.

Preliminary field tests have shown that use of the new belt increases production with additional economies in polishing costs.

The heavy mineral build-up of the "Three-M-ite" Multicut belt opens up under work pressure, presenting fresh abrasive grain particles to the work piece. This condition may be compared to "cracking", as known in the polishing field when glue and grain coated set-up wheels and belts are used.

The new belt is available in grit 60 and grit 150 aluminum oxide mineral in all standard widths and lengths. For more information on this material, use Reader Service Card.

E—1220. Dehumidifier and Filter for Compressed Air—The Vi-Speed® dehumidifier, self-cleaning device that purifies compressed air and reduces humidity to a very low dew point, has several new developments of internal design, while exterior has been streamlined for appearance, strength and safety.

Noteworthy improvements include self-adjusting nozzle coupled with non-clogging aspirator. This automatic control

Available for Immediate Shipment, Attractive Values

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

PLATERS

1—7500/3750 AMPERE, 6/12 VOLT, **MUNNING** "OPTIMUS."
1—5000/2500 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS,** 25° C., Synchronous, Exciter-in-head.
1—5000/2500 AMPERE, 9/18 VOLT, **COLUMBIA.**
1—5000/2500 AMPERE, 7/14 VOLT, **CHANDEYSSON,** 25° C., Exciter-in-head.
1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous, Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous, Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synchronous, Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **COLUMBIA,** Synchronous.
1—2000/1000 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS.**
1—2000/1000 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synchronous.
1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.
1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—1000/500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS.**

ANODIZERS

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON,** Exciter-in-head.
1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25° C.
1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—400 AMPERE, 40 VOLT, **M. G. C.,** Exciter-in-head.

RECTIFIERS

BRAND NEW BASIC RECTIFIERS, 1500/750 amperes, 6/12 volts. Special Price: $750.00 each. Separate Voltage Controls available.
1—2000 AMPERE, 6 VOLT, **G. E.** COPPER OXIDE, and Control.
1—**GREEN SELECTROPLATER,** 1800 AMPERE, 12 VOLT, 220/3/60.
1—**UDYLITE-MALLORY,** 1500/750 AMPERE, 6/12 VOLT, and Control.

SPECIAL

1—**MERCIL** 12 x 12 CENTRIFUGAL DRYER, Electric Heat.
1—**KREIDER** 12 x 12 CENTRIFUGAL DRYER, Steam Heat.
1—**CROWN** 18 x 18 CENTRIFUGAL DRYER, Steam Heat.
4—24" and 30" **ROBBINS & MYERS** 2-SPEED VENTILATING FANS.
3—No. 1 **HARTFORD** TRIPLE-ACTION BURNISHING BARRELS, Lined and Unlined, Belted.

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing

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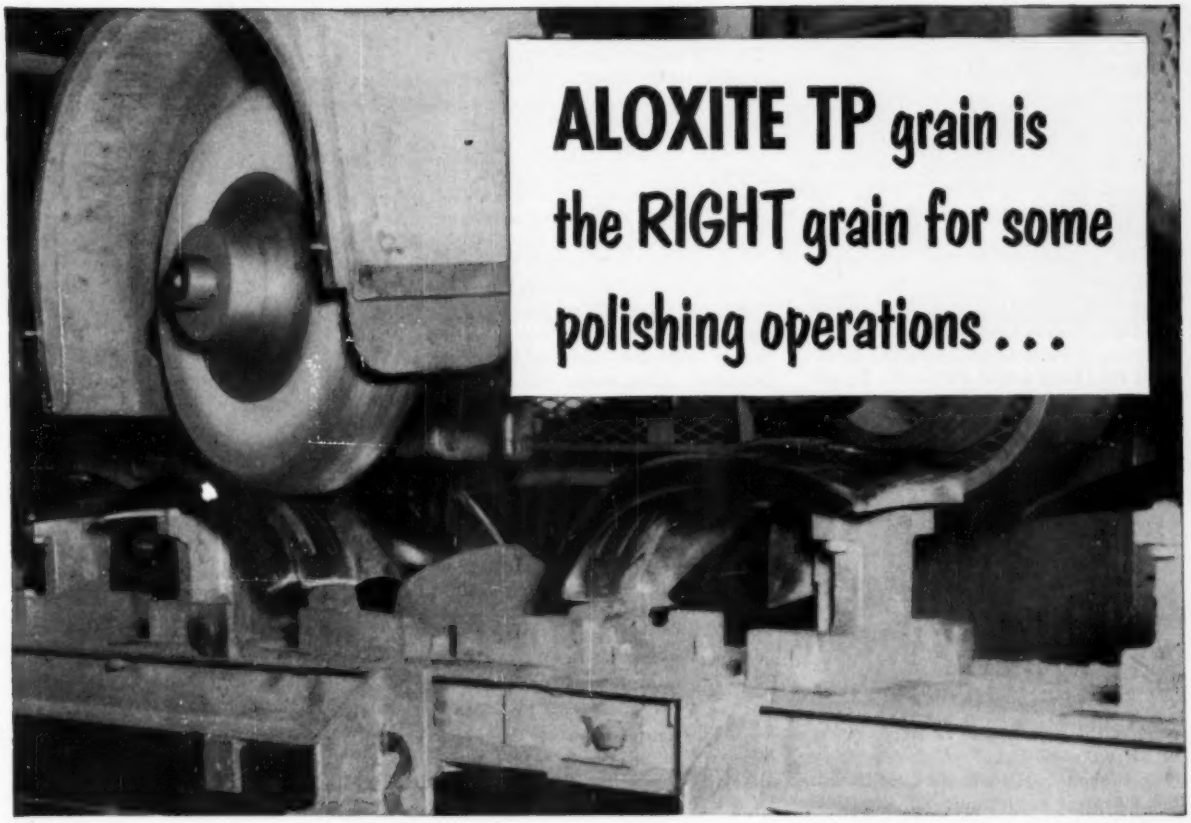
Klrkland 7-5460 **CAMBRIDGE 38, MASS.**



ALOXITE TP grain is the RIGHT grain for some polishing operations . . .

. . . and the right one for EVERY operation is among the other six in the complete line by CARBORUNDUM

ALOXITE TP grain is just one of the outstanding grain types in the most complete line available to industry. It's a tough, blocky aluminum oxide grain—ideal for polishing operations involving heavy stock removal on steel and other high-tensile-strength metals. If that's your problem, ALOXITE TP grain is *right* for you!

GRAIN TYPE	CHARACTERISTICS	PRIMARY USES
ALOXITE TPT Aluminum Oxide	Tough, sharp. Grits 16 through 100.	Polishing operations involving removal of large amounts of metal.
ALOXITE TPL Aluminum Oxide	Very sharp, friable. Grits 16 through 220.	Polishing low tensile strength metals—copper, brass, bronze, aluminum.
ALOXITE TPC Aluminum Oxide	Medium sharp. Grits 16 through 220.	General purpose polishing grain—for removal of small amounts of metal.
ALOXITE TPW Aluminum Oxide	Powder. Grits 240 through 1000.	As the abrasive in paste heading of polishing wheels and belts.
CARBORUNDUM RA Silicon Carbide	Sharp, very friable. Grits 10 through 240.	Polishing cast iron.
CARBORUNDUM RA Silicon Carbide	Powder. Grits 280 through 600.	General purpose polishing.

FOR FREE BOOKLET, "Abrasive Grain and Powders," write Dept. P 83-52R.

CARBORUNDUM

TRADE MARK

. . . the ONLY source for EVERY abrasive product you need

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, New York.

Equipment and Supplies

stabilizes unit operation during variable air pressures, and volumes for constant removal of injurious liquids, solids and vaporous contaminants. For additional data write to the manufacturer, Van Products Co., 3795P W. 12th St., Erie 2, Pa., or use Reader Service Card.

E—1221. Iolyte Crocks—Schori Process Division of Ferro-Co. Corporation, 8-11P 43rd Rd., Long Island City 1, N. Y., an-

nounces the manufacture of crocks made of Iolyte, a Fiberglas® reinforced polyester laminate. The manufacturer claims the following advantages: (1) Available from stock in popular sizes and capacities. (2) Crocks are of a chemically resistant structural plastic that cannot break or crack as glass and ceramic ones so easily do. (3) Material has the tensile strength of steel, at but one-fifth the weight. (4) Crocks are cylindrical in shape, not tapered. (5) They are inexpensive. For further information use Reader Service Card.

E—1222. PVC Pipe Fittings—Complete piping systems to handle corrosive liquids in industry have been made practicable with the addition of reducing brushings, plugs, unions and caps to the line of Boltaron 6200 fittings were announced by H. N. Hartwell & Son., Inc., Boston, Mass.

Used in conjunction with Boltaron pipe and valves of unplasticized polyvinyl chloride, the new fittings of the same material make possible a continuous system for use in solving plant corrosion problems. Now available in quantity, they are made in standard ips sizes (⅛, ¼, ⅜, ½, ¾, 1, 1¼, 1½, and 2 inches) matching the rest of the line. For more information, use Reader Service Card.

E—1223. Explosion-proof Laboratory Mixer—A versatile laboratory mixer has a motor UL approved for Class I, Group D, and Class II, Groups E, F, and G service. It is the only electric laboratory mixer designed for these service classes.

The mixer is recommended for simple fluid mixing, blending, solids suspension,

gas disperson, and in connection with mass transfer and heat transfer studies. It can furnish accurate data for determining scale-up relationships.

The unit rapidly mixes low-viscosity fluids in quantities up to 50 gallons and will mix lesser volumes of high viscosity fluids. For more information on the mixer, write the Mixing Equipment Co., Inc., 135P Mt. Read Blvd., Rochester 11, N. Y., or use Reader Service Card.

AVOID COSTLY REJECTS DUE TO UNACCEPTABLE COATING THICKNESS!

For quality control and acceptance tests, measure thickness of coatings on metals the easy, accurate, non-destructive way, with the . . .

AMINCO BRENNER **MAGNE-GAGE**

Widely used by industry and government for accurately measuring the thickness of:

1. Non-magnetic coatings (metallic or non-metallic) on magnetic base metals.
2. Nickel coatings on magnetic or non-magnetic base metals.
3. Composite copper-nickel coatings on magnetic base metals.

Measures coatings on plane, convex or concave surfaces. Gives speedy and accurate results. Easy to use by non-technical personnel.

Coating on cylindrical object being measured with the Magne-Gage.

Avoids expensive rejections due to coatings that may be too thin, or non-uniform. Eliminates the expense involved in replating or discarding specimens spoiled by destructive tests . . . every piece tested is unharmed and ready for use or shipment. Saves materials wasted by coatings thicker than necessary. Its use leads to the discovery of faults that may exist in plating methods or equipment.

Write for Bulletin 2150-Y

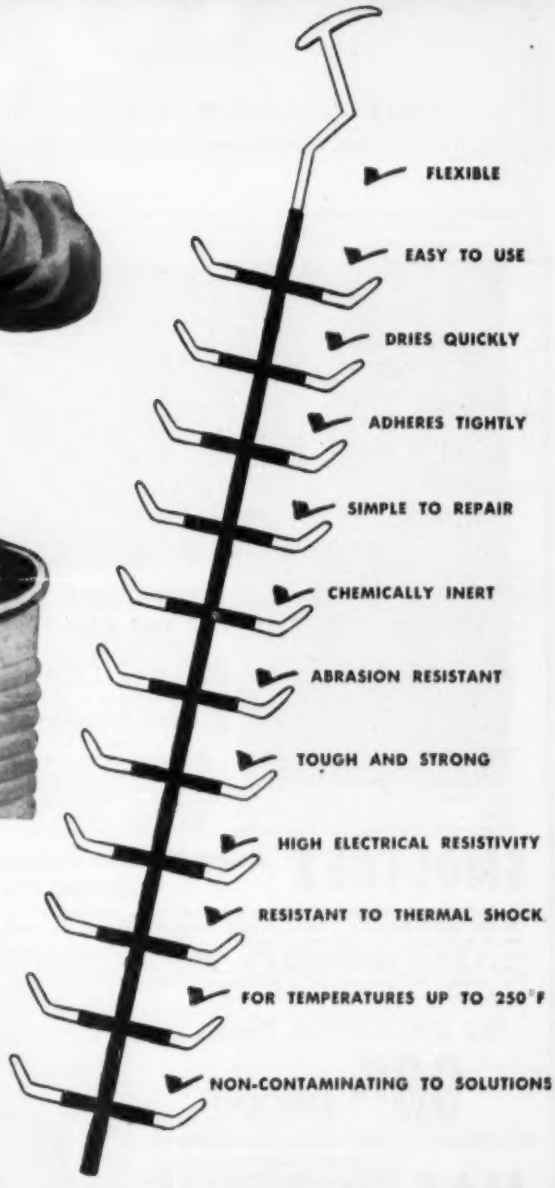
AMINCO Laboratory Instruments

AMERICAN INSTRUMENT COMPANY, INC.

Silver Spring, Maryland • In Metropolitan Washington, D. C.

STOP TREEING UP ON RACKS • CUT SOLUTION DRAGOUT
SAVE CURRENT • LESSEN MAINTENANCE COSTS

TYGON RACK COATING



- FLEXIBLE
- EASY TO USE
- DRIES QUICKLY
- ADHERES TIGHTLY
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- TOUGH AND STRONG
- HIGH ELECTRICAL RESISTIVITY
- RESISTANT TO THERMAL SHOCK
- FOR TEMPERATURES UP TO 250°F
- NON-CONTAMINATING TO SOLUTIONS

New "high-solids-content" Tygon *Air-Dry* Rack Coating 277 builds up a coating thickness of 20 mils with only four dips. This thicker, denser coating means less handling time, more plating cycles, lower plating costs.

Tygon Air-Dry Rack Coating 277 requires no primer — no baking — no complicated application. Just dip and air dry. The glossy black coating sticks like a leech — is resistant to all plating baths (not for use with trichlorethylene vapor degreases or aromatic hydrocarbons) — is electrically neutral, and possesses high dielectric strength.

Place a trial order today.

SYNTHETICS & PLASTICS DIVISION

280D

Merry Christmas
and a Happy New Year

from the

UNITED LABORATORIES CO., INC.
801 East Linden Avenue, Linden, N. J.

The Hardy Mfg. Co. of Indiana uses the above equipment and the SMOOTHEX Process to increase their plating production

EVERY USER OF THE NEW **SMOOTHEX**
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The entire machine occupies a floor space of only 25 x 25 inches. With it, any average machine operator or factory worker can perform precision lapping operations without having had special training. There are no chucks, collets, holders or tools needed. Moreover, as many as four operators may work at the Spitfire 24, thus providing additional means for reducing unit costs and speeding up assembly line precision lapping. For more information on this equipment, use Reader Service Card.

E—1225. PVC Pipe and Fittings—As an addition to its standard line of Ampcolite, high impact styrene pipe, and Ampcoflex, rigid polyvinyl chloride structures, Atlas Mineral Products Co., Mertztown, Pa., announces the availability of high chemical resistant high impact rigid polyvinyl chloride pipe and fittings. Polyvinyl chloride pipe is available in sizes ranking from ½ inch to 4 inch nominal pipe sizes. Molded fittings are available for pipe up to 2 inch ips and fabricated fittings are available for larger sized pipe.

The high chemical resistant pipe will be distributed country-wide under the trade name, Ampcoflex and the high impact pipe under trade name, Pee Vee Cee.s For more information on these material* use Reader Service Card.

E—1.26. New Parcolac—Two new products have been announced by the Parker Rust-Proof Company, 2169 E. Milwaukee Ave., Detroit 11P, Mich. They are Parcolac 101 Black and Parcolac 102 Aluminum, new pigmented phenolic resin finishes for use over Parco Compound.

Parcolac 101 Black produces a deep, intense black color; Parcolac 102 Aluminum creates an extremely even, light gray finish which looks like a plating of aluminum. Both products have excellent corrosion resistance. Production pieces, finished with these products, have withstood 100 hours in salt spray. For more information on these materials, use Reader Service Card.

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plating

Dedicated to the improvement and dissemination of the knowledge of the arts and sciences of electroplating and of finishing of metals and of allied arts.

DECEMBER, 1953 VOL. 40, No. 12

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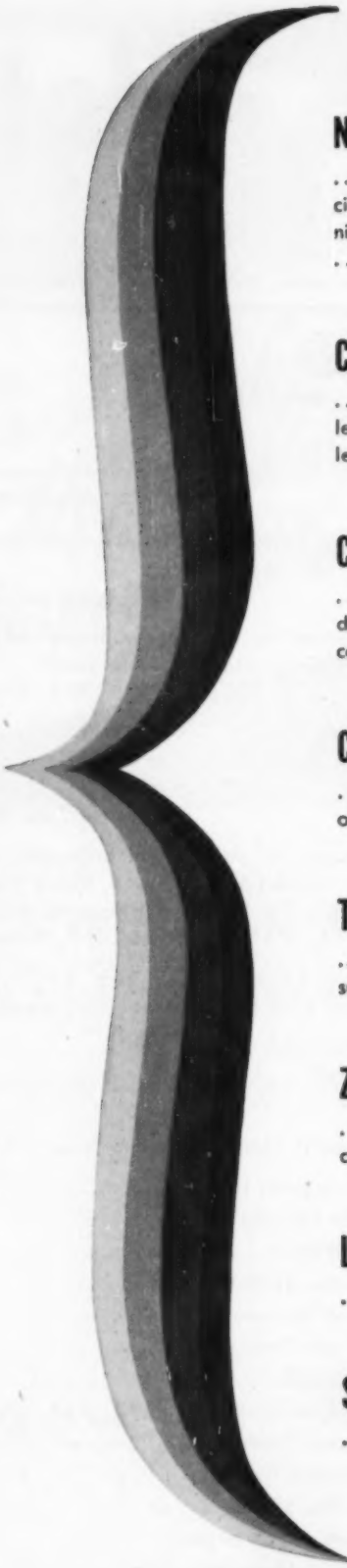

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Editorial

From Waste to Profits — In Water

THE COURSE OF HISTORY through the centuries often has been altered by the presence or absence of water. A repetition of the stark fact that a supply of good water is essential for industrial as well as social survival was reported in back-page press dispatches at the very start of 1953. At that time, drought induced power shortages in the Pacific Northwest and the Tennessee Valley areas resulted in losses of about 40 million pounds of aluminum per month. The drought continued throughout the year critically affecting potable water supplies and creating repercussions among food producers of the nation. It was only during the past few weeks that partial relief to this worst dry spell in twenty years was realized through some moderate rains.

This topical interest in water is no less meaningful to the metal finishing industry. The industry uses as much water as any industry, with the possible exception of the paper-making group. Now that the industrial use of water is becoming the subject of increased governmental controls, extra problems are added to the old bugaboos of the plater. Since the nation's population figures give promise to climb at an increased rate, no crystal ball is needed to see that controls will become more exacting.

Industry already has recognized the challenge it must meet. It has established various study groups whose activities have produced worthwhile results in a remarkably short time. The AES research program, through the work of two projects, has contributed data of immediate value in the attack on the problem. Aiding in this fundamental work are many commissions. Among them is the well-known 8-state agency in the Ohio Valley.

To these efforts may be added those of the individual manufacturing plants. Through good-housekeeping measures and other steps, the amount of waste water can and has been reduced with subsequent cost savings in overall operations. Numerous instances are on record where the dollar value of reclaimed materials from industrial waste water is in excess of the costs of the installation and maintenance of recovery systems.

It may well be that not all users of industrial water will show a profit in dollars and cents. But there will be those intangible profits that accrue in the form of civic and ultimate economic benefits for all.

Al Korbelak

We "planted" it in wartime

Two years ago next month we broke the news about "the palm tree that grows in Ohio" — Palmoshield, the domestic replacement for imported palm oil.

Users at this writing include most of the major tin plate producers of this country and Canada. They have found that Palmoshield, being a scientifically formulated product, is much more stable and uniform than the natural oil. In use it has helped increase tonnage as much as 15%. More important, it eliminates many of the variables which can prevent rolling clean, high quality steel.

...it flourishes in peace!

Today, the picture in steel is changing. With the pressure of production easing, increasing emphasis is placed on quality, on problems of finish and efficiency in operation.

Ironsides research, which developed Palmoshield, is now geared to these problems of the future. The same facilities which freed the industry from dependence upon foreign lubricants can now be focused on specific plant lubricating questions. Our engineers are available for consultation and technical assistance without obligation. Call or write Director of Research, The Ironsides Company, 270 West Mound Street, Columbus, Ohio.

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THE AMERICAN ELECTROPLATERS' SOCIETY RESEARCH PROGRAM*

DR. DONALD PRICE†

Two years ago at the Buffalo Convention, the author presented a rather detailed report[1] on the AES Research Program. At that time he tried to summarize in simple words what the various projects included in the program were aiming at, what they had accomplished up to that time, and the ways in which their findings would be of benefit to the electroplating industry. Of the eight projects active at the time that talk was given, two have been completed and their results published; two are being actively worked upon; two, officially listed as active, were at a standstill because of the inability to get Fellows; one which was temporarily inactive is being reactivated; and there are two very active new projects.

Shortly after the Buffalo Convention, the Research Committee suffered a great loss in the sudden death of its newly elected Chairman, Guy Cole. As provided in the By-Laws of the Research Committee it became the author's duty as Vice-Chairman Research to assume the Chairmanship of the Committee and to try to persuade some loyal member of the committee to take on the job of Vice-Chairman Research thus vacated. As the old saying goes, "When you want a job done, go to a very busy man". So the author went to his good friend, Walter Pinner. With some assistance from Past President C. F. Nixon, Walter's consent was obtained and he went to work with a will.

The first concern at that time was with the Committee's finances. Expenditures were running about forty thousand dollars a year, whereas collections from sustaining members amounted to only about thirty thousand. With a view to correcting this situation each of the active projects was carefully scrutinized to bring the picture up to date. It was not desired to save money by cutting productive research off right in the middle; consequently, it was not possible to cut expenses very much at the start. However, by studying the whole program carefully, the Committee found it possible to inactivate certain projects which had already accomplished good results, and which had come to a logical stopping place, without damage to the research program as a whole. In this way the budget was balanced gradually. The author is happy to say that for some time now the Committee has been operating well in the black ink. It is only fair to say that a large share of the credit for this result is due to the hard work of Vice-Chairman, Finance, Clyde Kelly, to Ray Ledford and the other active workers on their committee.

It is not the author's intention to discuss in detail the work of each of the active projects. For more than a year now, every issue of PLATING has carried at least one publication from a Research Project sponsored by the Society. These publications speak for themselves and demonstrate the activities of the Research Committee better than the author could.

Project No. 5 at Michigan State College, under Professor D. T. Ewing, continues its fine work on The Effect and Removal of Impurities from Electroplating Baths. Papers on chromium and on lead are being prepared for publication and the effect of aluminum is under investigation. This group is to hear from Professor Ewing later in this session[2].

Project No. 12, Cleaning and Preparation of Metals for Electroplating, at Columbia University under Professor Henry Linford, has finished its work on degreasing evaluation tests and has published the last paper of this series in PLATING[3]. Oxide films and tests for their removal are now under study by this project.

Project No. 14, the Canadian Project, carried on in collaboration with the Ontario Research Foundation, has been doing excellent work on The Effect of the Condition of the Basis Metal Upon Plating. Dr. A. E. R. Westman will give a report on the work of this project this morning[4].

Project No. 2, under Professor Earl J. Serfass at Lehigh University, which was inactive for a time is now being reactivated for the study of Macro Methods of Analysis of Plating Solutions. A report from Professor Serfass is scheduled for this morning[5].

Project No. 10 at Yale University under Professor B. F. Dodge, while officially active, is temporarily at

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*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 18, 1953.

†Technical Director, Oakite Products, Inc., New York City, N. Y.

a standstill because of the resignation of Dr. Zabban. Until recently the Committee has been unable to replace him with another Fellow to carry on experimental work. Professor Dodge now reports that he has been successful in securing a Fellow who will begin work in September.

Project No. 13 at the National Bureau of Standards, which is studying Porosity in Electrodeposited Coatings, was in the same position as Project No. 10. Mr. Fielding Ogburn, the Project Director, has just reported that he has secured a Fellow and that experimental work will be resumed in the near future.

Project No. 15 on Accelerated Corrosion Tests has been extremely active and has been making very substantial progress. This project is unique among AES Research Projects. Many individuals and organizations interested in the problem have given time, services, and equipment, far beyond what the Research Committee ever could afford to pay for. The writer shall not discuss the work of the project since Walter Pinner, the Project Director, is to do so at this session[6].

One of the innovations that has been made in the procedure of the Research Committee during the last few years has been a more systematic method of selecting Research Projects. The first step is to appoint a Task Committee of persons who are experts in the particular field under consideration. These persons are not necessarily members of the Research Committee and need not even be members of the American Electroplaters' Society. The main point is to get highly qualified experts. This Task Committee is asked to survey the particular problem that has been suggested and to report whether in their opinion it is a suitable problem for a Research Committee to undertake, to suggest methods of attack to the problem and if possible, to suggest the name of a man best qualified to carry out the work. When this Task Committee has presented its report, the Research Committee studies it and decides whether or not to set up a new Research Project. Four such Task Committees are now active, one of which has just submitted its final report. By the method outlined, it is felt that the Research Committee obtains a more representative cross-section of opinion by seeking the advice of specialists than it could do on the basis of its own judgment alone. It is felt too that this method eliminates the danger of adopting the "pet" project of any individual or individuals which might be restricted in scope and fail to serve the broader interests of the whole Society.

In common with every institution or industrial concern carrying on research at the present time, the AES Research Committee is faced with a serious situation due to the acute shortage of trained chemists. A shortage of technically trained manpower has been building up in various fields for several years, until now the demand for recent graduates in chemistry, physics, and engineering far exceeds the supply.

Among the reasons that have been put forward to explain the situation are:

1. The lowered birth rate during the depression, which has resulted in fewer persons of the age to enter college at the present time.
2. The draft, together with the lack of a clear-cut policy relative to the deferment of technical personnel.
3. The tremendous expansion of research both by industry and the government and especially by the Atomic Energy Commission.

Whatever may be the reason for the situation, the fact remains that research organizations find themselves competing for a diminishing supply of trained people. The AES Research Committee offers fellowships that give students the opportunity to get paid while earning a college degree, but in many cases, these fellowships have gone begging. A few years ago, there would have been active competition for opportunities of this kind. Authorities on the subject generally agree that the technical manpower situation will get worse before it gets better.

Now, if the electroplating industry is to prosper in the future, intelligent young men must be encouraged to enter the field. Your Research Committee has sent out information on its fellowships to colleges throughout the country to be posted on bulletin boards, and is doing everything it can to encourage able young students to take up research in electroplating. But its efforts have met with little success. The writer would, therefore, urge all of you, as members of the AES, to help your Research Committee and your industry by calling attention to the opportunities offered by the electroplating field and to the fellowships made available by your Society.

Several things impress the author as he looks back over the years he has been associated with the research program of the American Electroplaters' Society. First and foremost is the large number of high caliber men who give their time and energy freely to the program without any thought of reward except the satisfaction of a job well done. Indeed, they often get a lot of criticism. There is no quarrel with this; criticism is healthy if it is constructive and leads to better ways of doing things. But the Society should realize that it is very fortunate to have so many loyal members willing to devote their time to supervising the research program so as to be sure that the sustaining members get their money's worth. Services of this kind cannot be bought at any price.

The author wishes to discuss one more point before closing. He has believed for a long time that there is a crying need for interpretation of the research published by the Research Committee in simple, everyday language. The research results coming from the various AES projects must be published somewhere for the record in the usual scientific form so that scientists all over the world may study and use them. Furthermore, it is only proper that the research results be published in the Society's journal, PLATING. But what about the busy plater who may not have the time or even the necessary scientific background to

get the full benefit of research results published in this form? The AES research publications contain results of great value to the plater, but they would have far greater value if they were not buried under a mass of technical terms and figures. The plater is very much interested in what was found out, but much less interested in how it was found out.

This problem has been discussed many times in the Research Committee meetings and one always runs into the same stumbling block: Where to find men with the necessary combination of technical background, practical knowledge and writing skill to boil down the research papers to essentials and tell the plater in simple terms how he can use the results. So far it has not been possible to come up with the answer, but certainly one ought not to give up because the problem is a tough one. In fact, progress has already been made. The very comprehensive paper on the physical properties of nickel deposits published[7] in PLATING last summer has been rewritten in simplified form and has been published in "Materials and Methods"[8]. It has been published also in pamphlet form. This has only been made possible by the generous support of the International Nickel Company. It is a big step in the right direction and it is hoped that such efforts will continue.

In conclusion, the author wishes to express his gratitude for the opportunity that his association with the Research Committee has given him to make so many good friends. He wishes also to express his sincerest thanks to all the men who have worked with him as officers and members of the Research Committee, as Chairmen and members of Project Directing Sub-Committees, and who have all contributed so much more toward advancing the Society's research program than he has done.

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[4]Ibid 40, 1366–1375 (1953).
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[8]Materials & Methods 37, No. 4, 101 (April, 1953).

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Recent Facts on Metals

Aluminum

Representatives of the aluminum industry, including primary producers, prime aluminum products producers, smelters and others, conferred with officials of the Business and Defense Services Administration, Department of Commerce, and the Office of Defense Mobilization on an industry request that the Government modify aluminum stockpiling specifications.

Some industry representatives present said that they are having difficulty in meeting the required specifications. It was pointed out that, until new facilities are given time to produce high quality aluminum, some primary producers will find it difficult to meet their stockpile obligations for specified grades and at the same time fill their commercial orders from the available supply.

*Tin**

A growing competitor to conventional metal pipes is the rigid vinyl plastic pipe. On the Continent it has already captured a very large share of the business in the field of piping for corrosive chemicals. In Holland it has been extensively adopted for domestic water service piping.

Heat is used in the process of manufacture of PVC pipe. The effect of heat on polyvinyl chloride is to initiate the evolution of hydrochloric acid. The hydrochloric acid itself acts as a catalyst for this decomposition reaction.

The reaction is exothermic and its rate doubles for every 10° C rise in temperature. Unless some control is instituted, the polymer will be rapidly dehydrochlorinated forming a highly colored and somewhat unstable polyene. In extreme cases the reaction will build up to a violent explosion.

It is here that tin plays its role. Such compounds as dibutyltin dilaurate and dibutyltin maleate are among the most effective stabilizers for polyvinyl chloride resins which have yet been developed.

They are prepared by the classical Grignard method.

When a small quantity, say 2 per cent, of dibutyltin dilaurate is added to polyvinyl chloride the small amount of hydrochloric acid released by the polymer is immediately absorbed by the organotin compound, forming dibutyltin dichloride and lauric acid, both of which dissolve in the resin itself. The decomposition is thereby inhibited by the removal of the catalyst, and can only proceed at its slow uncatalyzed rate, the products of decomposition being absorbed by the stabilizer.

* From "Tin and Its Uses", 29 September, 1953.

A METALLOGRAPHIC STUDY OF SOME STEELS USED FOR NICKEL PLATING*

A. E. R. WESTMAN† AND F. A. MOHRNHEIM†

Abstract

In connection with AES Project No. 14 entitled "The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating" a number of steels used by electroplaters and a number of electroplated articles made therefrom have been examined by various metallographic techniques including conical illumination, phase contrast illumination and taper sectioning. Major differences between the steels and the way in which they originate are described. Investigation of several coatings which failed to provide protection indicates that the basis metal may be a contributing factor but more controlled investigation is necessary.

Introduction

AES Research Project No. 14 is entitled "The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating". This means that it is concerned with any factor which may influence the properties of a plated article by affecting the properties of the basis metal. In keeping with Society policy, the literature has been surveyed, a bibliography has been prepared and a critical review is now in preparation.

In order to avoid dissipation of effort, it was decided to concentrate initially on the basis metal steel with nickel or nickel-chromium or copper-nickel-chromium as the electrodeposited coatings.

The review of the literature showed that there is no general agreement as to the effect which the properties of the basis metal steel may exert on the properties of the finished electroplate. For example, support may be found in the literature for the conflicting statements[1] that the properties of an electroplate are unaffected by wide variations in the polishing procedure and[2,3] that any polishing operation leaves a disturbed metal surface which provides an insecure basis for electroplating. However, the literature review did show that more conclusive work in this field would require that more attention be paid to the metallurgical history of the steels used.

Since the general question of the effect of basis metal properties will be discussed in detail in the forthcoming critical review, the authors propose to limit their remarks to a report on a metallographic study, now in progress under Project No. 14, of steel currently used for electroplating.

This study was undertaken with three purposes in mind: (1) to find what range of steels was being used in electroplating, so as to be able to plan Project investigations more effectively, (2) to perfect current techniques for studying the zone of contact between the basis metal and the electroplate, and (3) to study some plating failures in which the basis metal might be at fault.

Current techniques are (1) ordinary metallographic sections, (2) taper sections, (3) Dr. A. T. Steer's[3] mild etching techniques, and (4) electron microscope studies. This report shall be concerned with the first two only.

How Do Steels Differ?

In considering steel as a basis metal for electroplating, the first question is "How do steels differ in their properties"? This is a large subject. It will be sufficient for the present report to discuss three important aspects of this question, namely, (a) chemical analysis, (b) ingot practice, and (c) rolling practice. All three have an important influence on the metallographic structure of a steel.

With regard to chemical analysis, it will be sufficient to point out that when a specimen of practically pure iron is cooled slowly from the molten condition, it will consist almost wholly of rather large grains of ferrite. If some carbon is present, one would find, in addition to ferrite grains consisting of pure iron, some regions with a pearlite structure. This is a structure in which dark bands of cementite (iron carbide, Fe_3C) alternate with bands of ferrite. Normally, the amount of

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*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 18, 1953.

†Project Director and Research Fellow, respectively, A.E.S. Project No. 14, Department of Chemistry, Ontario Research Foundation, Toronto, Canada.

pearlite increases as the carbon content is raised.

In the manufacture of steel, the molten steel first is allowed to solidify in molds to form large *ingots*. The particular practice followed may have a very pronounced effect on the properties of the rolled strip or sheet, particularly on the surface properties which are of such interest to electroplaters.

Depending on the practice used, steel may be classified as killed, semi-killed, capped or rimmed, the amount of gas evolved from the steel in the ingot mold increasing in the order named. The effect on the ingots may be illustrated by Fig. 1, in which Ingot 1 would be classed as a fully killed steel and Ingot 7 as a typical rimmed steel. In the fully killed steel very little gas was evolved as the steel solidified, there is no rim at the outside which differs in composition from the rest of the steel and the shrinkage on solidification creates a large "pipe" at the top. In the rimmed steel, there was active gas evolution and stirring when the "rim" was solidifying and this rim tends to be relatively pure iron or ferrite. The honeycomb structure counteracts the normal shrinkage of the ingot. Semi-killed and capped ingots have intermediate characteristics.

This difference between rim and core in a rimmed ingot persists through the rolling process, and the final product, if in sheet form, consists of a sandwich formed by two thin layers of relatively pure ferrite separated by a core in which are found any pearlite, nonmetallic inclusions and impurities. Since ferrite grains are relatively soft, rimmed steel is usually preferred for drawing purposes. Whatever type of commercial steel may be considered, it will contain nonmetallic inclusions. These will vary in character according to the manufacturing process.

All steel is hot rolled initially but some is pickled and further cold rolled to produce what is called cold-rolled steel. The rolling and annealing practice which is followed may have a profound effect on the nature of the surface produced.

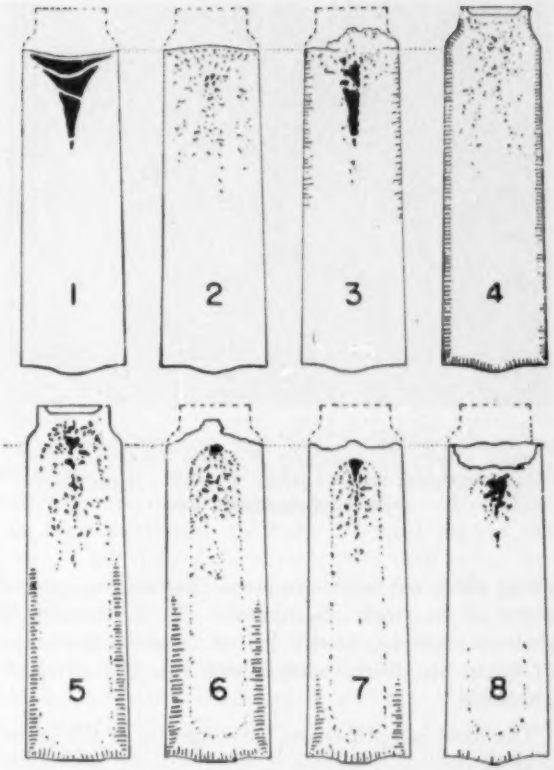

Fig. 1. Diagrammatic sections of typical steel ingots. 1—killed; 2 and 3—semi-killed; 4 and 5—capped; 6, 7 and 8—rimmed. (From "The Making, Shaping and Treating of Steel", 6th ed. U. S. Steel Company, Pittsburgh)

Chemical Analyses

Of the 16 steels investigated to date, 12 were 1010 steels whose analyses are indicated in Fig. 2. The low silicon contents indicate that these were rimming steels. The four other steels had carbon contents above 0.10 and their analyses are shown in Fig. 3. The higher silicon contents show that these were killed steels.

Photomicrographs of Steels

To illustrate the work under way in the survey of

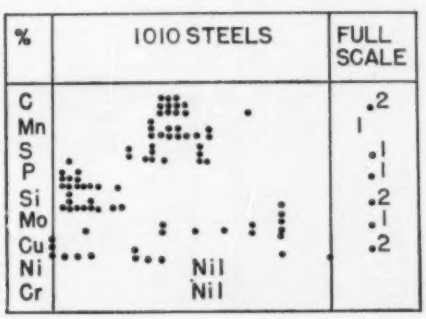

Fig. 2. Chemical analyses of twelve 1010 steels examined

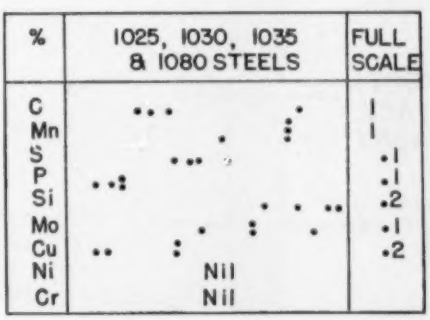

Fig. 3. Chemical analyses of four medium and high carbon steels examined

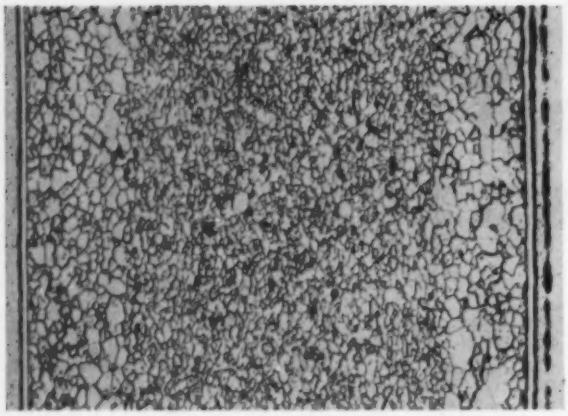

Fig. 4. Section through Lux and Blum panel at right angles to polishing direction (100X). Left side—original rolled surface of steel. Right side—polished surface of steel

steels, there will be shown some photomicrographs of a few of the steels investigated. (In the lecture, 30 photomicrographs, mostly in full color, were shown. Of these, 11 are reproduced with this text in black and white.)

The most comprehensive investigation of the effect of the basis metal surface on electroplating was made by Lux and Blum[1] of the National Bureau of Standards and published in 1945. They used a "special" S.A.E. 1010 cold-rolled steel with a remarkably smooth surface (2–4 microinches rms) and subjected it to various polishing procedures. Fortunately some of their experimental panels had been preserved and were made available to the Project.

Fig. 4 shows a polished section of a Lux and Blum panel made at right angles to the polishing direction. The left side shows the original smooth surface produced by rolling; the right side, the polished surface. The appearance of the steel itself indicates that it was a rimming steel.

Fig. 5 shows the left side of Fig. 4 at much higher magnification. The steel base, copper undercoat and nickel plate are clearly seen. Even at this magnification, the trace of the basis metal surface appears like a smooth line.

Fig. 6 shows the right (polished) side of Fig. 4 at the same magnification. The rougher surface of the basis metal is evident and there appears to be a disturbed layer of material between the basis metal and copper undercoat. It should be noted, however, that the peak to trough distance at the basis metal surface is very small in comparison to the thickness of the electroplate (0.001 inch). Consequently, if the roughness of the surface is to contribute to corrosion failure of the electroplate, it must be due to some irregularity in the surface carrying through the electroplate or some sliver of considerable length, and not merely to the electroplate being slightly thinner where the basis metal has a high spot.

Taper Sectioning

In order to investigate the disturbed layer of metal just at the junction of the basis metal and electroplate, taper sections were prepared.

The principle of taper sectioning is illustrated in Fig. 7. By taper sectioning at approximately 5°, there is secured a vertical magnification of 10 to 1 of any extended layers or any scratches that cross the plane of sectioning. It should be noted that no magnification results with an equi-axed grain.

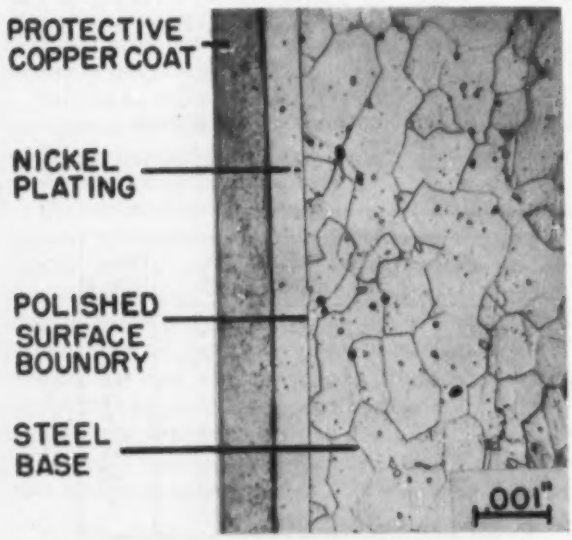

Fig. 5. Lux and Blum panel—unpolished side (500X)

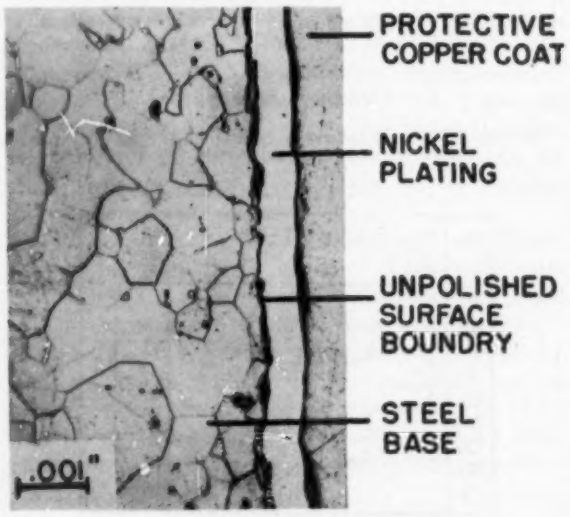

Fig. 6. Lux and Blum panel—polished side (500X)

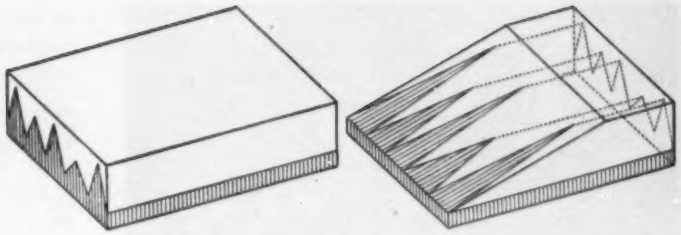

Fig. 7. Profile as shown by usual perpendicular sectioning (left), compared with the magnified profile obtained by taper sectioning (right). (After Kellner, Proc. Am. Electroplaters' Soc. 37, 109 1950)

Fig. 8 shows a taper section of the polished side of the Lux and Blum panel under conical illumination. The ups and downs are now magnified and the disturbed layer of basis metal is made more evident. It is clear that some of the basis metal has been nearly detached in the polishing process. Fig. 9, which is a taper section of the unpolished side of a panel, again shows its remarkable smoothness even under a magnification of 900x (approx.) verticle taper, 10:1.

In the above sections there was some evidence that the disturbed layer of the basis metal resisted polishing and etching more than the nickel plate. This was investigated by using special types of illumination such as conical illumination and phase contrast.

It was found that the disturbed layer of metal stood out in high relief from the electroplate giving the appearance of an escarpment.

In the early stages of the Lux and Blum investigation, difficulty was encountered in securing adhesion to this disturbed layer; so more aggressive cleaning procedures than at first contemplated had to be employed. The cleaning procedures used commercially today are even more aggressive so that this disturbed layer may be removed to a greater degree.

Fig. 10 shows the cross-section of a bolt of 1030 or medium-carbon steel. The pearlite grains are quite evident. The carbide in the pearlite is tending to spheroidize. This suggests that the steel has been annealed rather than normalized.

Among the specimens examined was a parking light housing which had shown poor corrosion resistance where the basis metal had been deformed severely in the forming process. A section through the basis metal and chromium-nickel electroplate on a flat surface where the basis metal had not been deformed showed the basis metal to be a low-carbon steel with rather numerous nonmetallic inclusions but revealed no faults in the electroplate. However, sections made at bends and sheared edges revealed that there were numerous cracks through the nickel plate which penetrated to the basis metal. These cracks and not any lack of thickness of the plate were responsible for the poor corrosion resistance. Conditions in the plating bath were probably responsible for the cracks but stresses in the basis metal may have been a contributing factor. Fig. 11 shows a section near a sheared edge. The deformation of the steel has elongated and curved the nonmetallic inclusions. The cracks through the electroplate are clearly seen.

Having been impressed with the very smooth original cold-rolled surface on the Lux and Blum panels, the authors thought it would be of interest to see what the steel companies use themselves when they wish to apply a tin coating. Surfaces of typical specimens

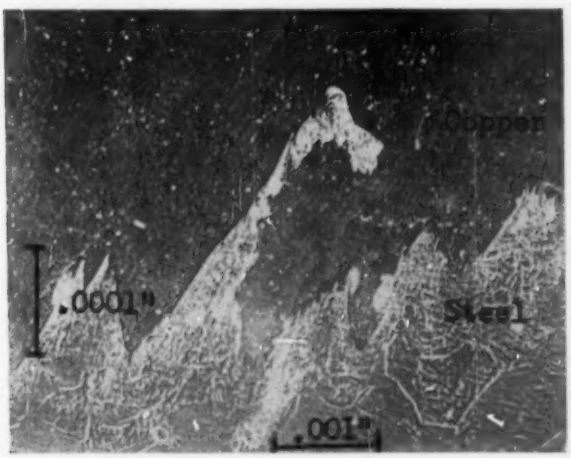

Fig. 8. Lux and Blum panel—polished side. Taper section under conical illumination (625X). Verticle taper, 10:1

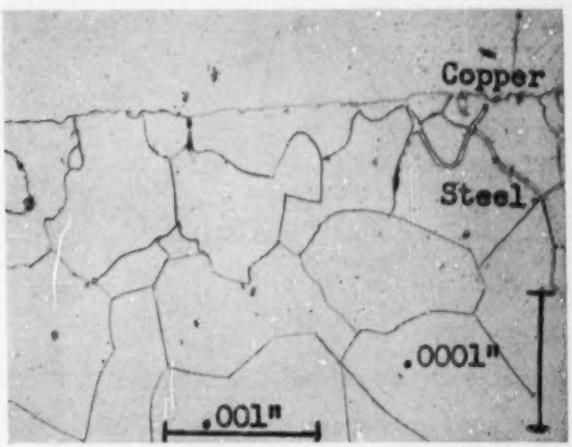

Fig. 9. Lux and Blum panel—unpolished side—taper section (900X). Verticle taper, 10:1

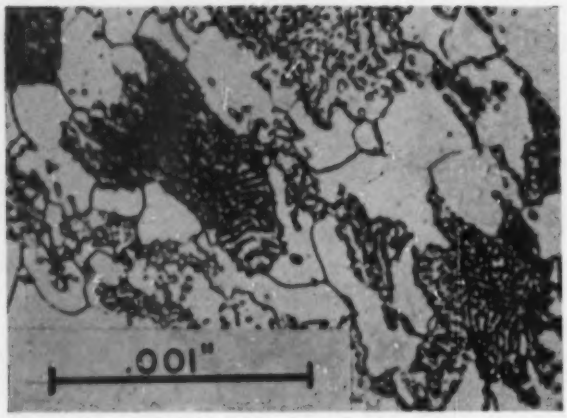

Fig. 10. Section of hub bolt of medium carbon steel (1030). Dark areas are pearlite (1500X)

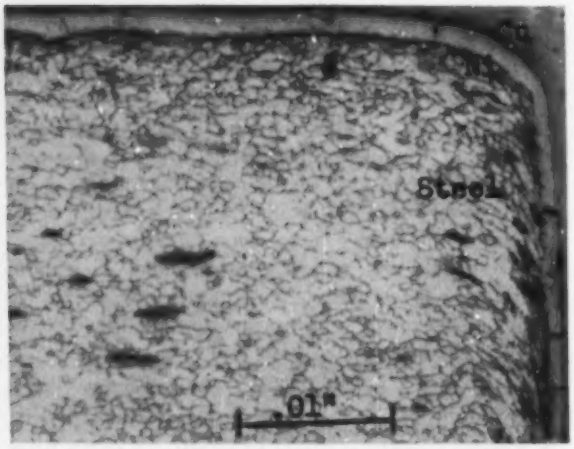

Fig. 11. Parking light housing. Section near sheared edge showing cracks in electroplate (90X)

of tin plate were protected during metallographic polishing by applying a nickel and then a copper coating.

Even at 500x (approx) and with taper sectioning, the appearance of the surface of a No. 3 special plate was surprisingly good, as shown in Fig. 12, even if somewhat pebbly when compared to the Lux and Blum panels. There was little evidence of a flowed or worked zone. It should be noted that with pebbly surfaces consisting of approximately equi-axed grains, taper polishing does not result in the usual magnification.

Another interesting specimen examined was an automobile bumper guard. This had developed elongated corrosion blisters on exposed surfaces, whose shape and arrangement are shown in Fig. 13. It was thought that they were related to the polishing process, and after stripping off the plate it was shown that they did parallel the polishing scratches. Fig. 14 shows a section through a corrosion blister. It is filled with corrosion products. The steel has been strongly attacked and there is a tendency for corrosion to spread along the interface between the steel and the copper undercoat. A peculiar feature was the appearance at the steel-copper boundary of what the authors have called a "palisade" layer. This has the appearance in a taper section of a row of parallel elongated crystals. In some sections it appeared to be in the steel and in others in the copper. This is shown in Fig. 15. This palisade layer was attacked rapidly and allowed the corrosion to spread laterally at a rapid rate. Possibly it corresponds to the transverse fissuring reported by Dr. Steer[3].

Reference is now made to a section of a nickel plate on hard, carburized steel. Fig. 16 is a section of a skate blade which showed fine parallel cracks after plating. Two cracked nickel plated surfaces have been clamped together for sectioning. It is evident that it is primarily the basis metal which has cracked, probably from hydrogen embrittlement in the pickling process.

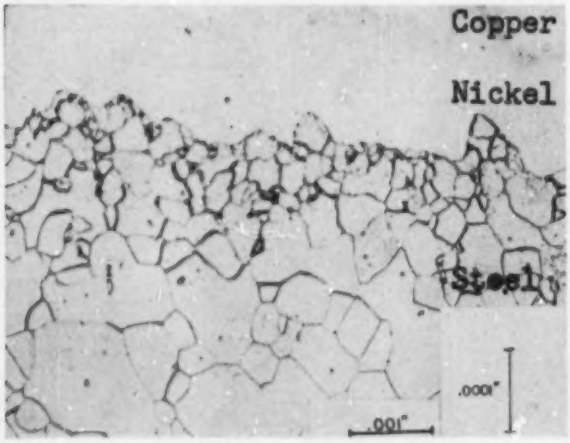

Fig. 12. Special tin plate. Taper section (500X)

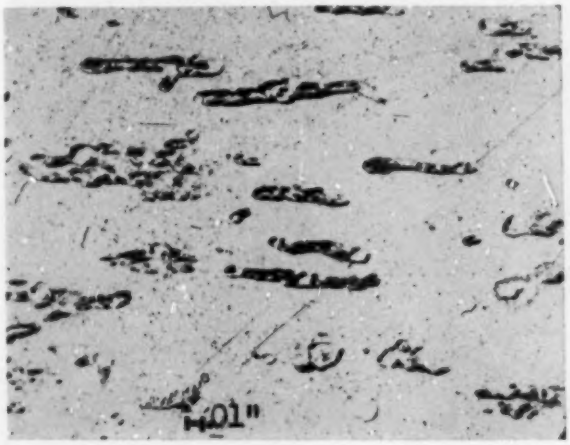

Fig. 13. Bumper guard. Photograph of blistered surface of electroplate (12X)

Fig. 17 is a photomicrograph of a thick chromium electroplate on steel which was made in connection with the formation of nodules in the plate. The nodule in this picture has been loosened by corrosion. Of more interest to the Project is the fact that a step in the steel surface shown just to the right of center, evidently due to a machining fault, has been reflected in a corresponding step on the surface of the plate and by a line of weakness going right through the plate.

This question as to how and under what conditions a disturbance in the surface of the basis metal may create a zone of weakness which penetrates the electroplate and provides a path for corrosive attack is one of the most important questions that has arisen in this Project. Examination of failures may tell something but the results of such examinations are often open to conflicting interpretations. Carefully controlled experiments will be necessary to decide this and similar questions regarding the influence of the basis metal.

However, enough has been done to show that the properties of the basis metal and their relation to electroplating properties provide an interesting field for study and one which the electroplater can hardly overlook.

Acknowledgment

Finally it should be pointed out that Project No. 14 is being carried on at the Ontario Research Foundation as a group research project supported in part by the Research Council of Ontario. The authors also wish to make the following acknowledgments: Metallurgy—Dr. O. W. Ellis, Director, Department of Engineering and Metallurgy; Electroplating—Mr. W. M. Tucker and his Project Committee; Finances—Mr. C. Short and Mr. Kergan Wells of the Toronto Section.

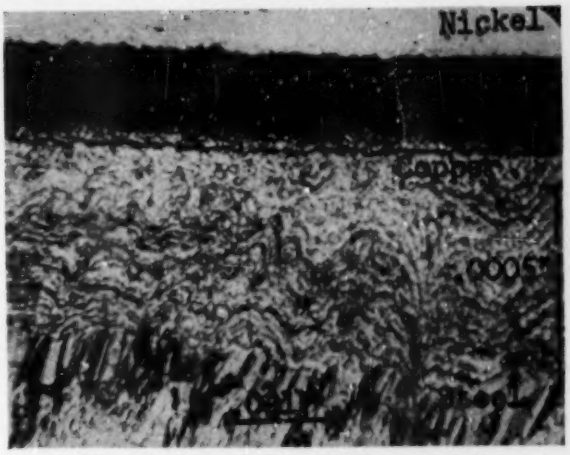

Fig. 15. Bumper guard. Taper section of unattacked surface. Note palisade layer at surface of steel. The dark fine-grained copper layer is due to buffing (700X). Vertide taper 4:1

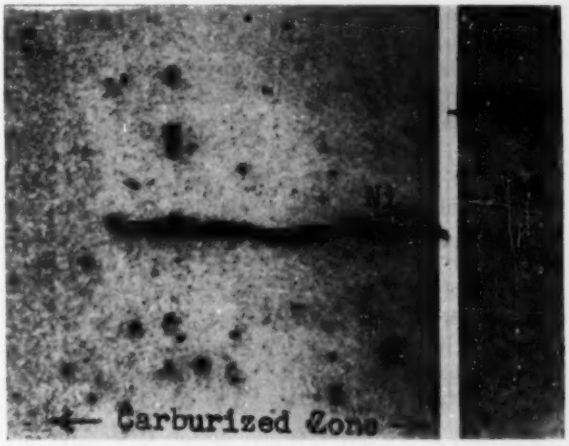

Fig. 16. Section through skate blade. Two electroplated surfaces clamped together for polishing. Cracks in plate evidently due to cracking of carburized zone of basis metal

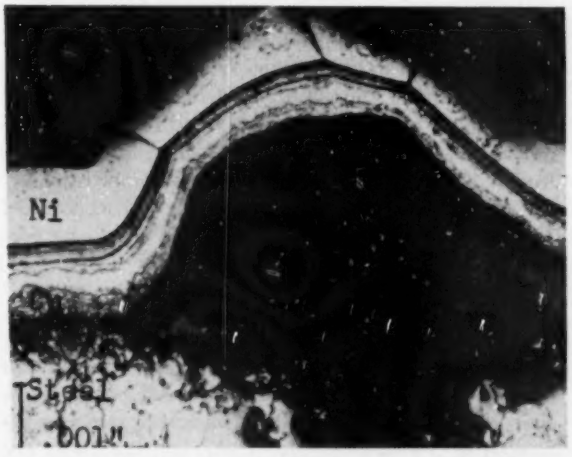

Fig. 14. Bumper guard. Taper section of corrosion blister. Note spread of attack along copper-steel interface (125X). Vertide taper 5:1

Fig. 17. Chromium plated steel cylinder. Imperfection in steel surface reflected in electroplate (125X)

APPENDIX

Taper Sectioning, Multi-Etching and Color Photography of Metallographic Specimens

The above paper was illustrated by lantern slides showing taper sections in color. Much interest was expressed in the details of techniques employed to prepare the slides. In order to answer the many questions asked, the memorandum that follows was prepared. It describes the technique presently employed by the Project for (1) taper sectioning, (2) multi-etching, (3) color photography and (4) lantern slide preparation.

Taper Sectioning

The classical method for examining profiles of metal specimens is to cut a section from the specimen perpendicular to the surface and at right angles to the direction of the main scratches or lay. This is recommended as a preliminary step to taper sectioning. To prevent distortion of the edge during polishing, the specimen first is given a relatively thick electrodeposit, such as copper for nonferrous metals and nickel for steel specimens. In preparing samples the authors recommend the use of a Rochelle copper salt bath or all-chloride nickel bath to secure good covering power. Care should be taken in the selection of the cleaning procedure prior to the deposition of the protective plate, for it is obvious that strong etching will change the original profile. The cut section is mounted in a plastic such as Lucite with the specimen itself at right angles to the surface to be examined. Lucite was found to be advantageous for this work since the position of the specimen can be seen readily.

For still better preservation of the flatness of the edges it is highly recommended that the steel specimens be mounted between steel plates, the edges of which are parallel and as close as possible to the edge of the specimen to be examined. One way to achieve this is to drill one or two holes through the specimen and the steel plates and then to bolt them tightly together. Steel clamps of adequate shape and dimensions also may be used to secure a satisfactory preservation of the edges. The surface of the cut edge is ground and polished with the usual series of successively finer metallographic polishing papers, ending with 4/0 which is used parallel to the line of the profile. The specimen is then given a final metallographic polish with an abrasive powder*. Good results can be obtained on a polishing wheel under ideal operating conditions. Hand polishing is slower but will sometimes preserve greater detail.

Having examined the prepared specimen under the microscope and recorded its appearance on photomicrographs, the authors cut the imbedded specimen on a grinding wheel at a definite small angle. For reason of convenience, a taper section of 5° 43′ is suggested which gives a ten-fold magnification in the vertical direction. However, sometimes a smaller or larger angle may be more practicable. The angle or the exact magnification can be easily calculated by the geometric relation

$$\text{cosecant of the tapering angle} = \text{magnification obtained} = \frac{\text{apparent thickness of specimen in the taper section}}{\text{actual thickness of specimen}}$$

The actual thickness of the specimen may be measured with a micrometer before mounting. This, together with the measurement of the apparent width in taper section, and subsequent substitution in the above relationship may be used as a guide in polishing the taper section to the correct angle.

The new plane, which appears to be at almost right angles (90°–5° 43′) to the one initially investigated, is again ground and polished with the usual series of successively finer metallographic polishing papers ending with 4/0 also used parallel to the line of the profile. Then the sample is mounted again in Lucite with the new plane in a horizontal position. In this way, one regains the handy form of the regular Lucite cylinder. After final polishing, the taper section is ready to be investigated under the microscope.

Multi-Etching

Although etching is regarded by many investigators as superfluous as well as dangerous to detail of the edges, it was found very advantageous to use cautiously a mild etching in order to get greater detail of the structure of the different layers. To develop the grain structure of the basis metal, 2 or 3 per cent Nital at room temperature applied for approximately 10 seconds was found to be satisfactory. In order to develop the structure of the copper undercoat when present, the authors etched subsequently with a copper ammonium sulfate solution. This solution should be freshly prepared at a temperature of approximately 70° C and is made by adding 10 ml of concentrated NH_4OH to approximately 50 ml of hot 5 per cent copper sulfate solution.

Color Photography

The natural color contrasts of the metals involved have been very useful in Project investigations, especially for complex layers such as multilayers in electroplating. Unfortunately, these contrasts are not

*Linde Abrasive powder, Grade A.

shown up in the usual black and white photomicrographs. The Ektachrome[4] process was found to be an excellent means of reproducing natural colors in transparency form. A good photovoltmeter[5], a well-controlled carbon arc lamp (10 amp, 55 volt exactly), as light source, appropriate light filters[6], and a proper set of apochromatic or fluorite lens combinations[7] were used and are recommended for this work. A Leitz Panphot Microscope was selected for simplicity of its optical system, introducing a minimum of errors in color reproduction. If the working directions of the film manufacturer for the color film process are carefully observed, there should be no difficulty in getting satisfactory results.

Lantern Slide Preparation

In preparing a lantern slide, the legend, showing the different components of the specimen and the magnification obtained in the two directions, was typed and drawn on a proprietary slide material (3¼ x 4 inches Amber)[8]. Magnifications were indicated by double arrows showing the distance corresponding to, usually, a thousandth (horizontal) and a ten-thousandth (vertical). The transparent sheet from the proprietary slide material was then mounted, along with the transparency and a lantern slide mat 3 x 2 7/16 inches between two pieces of lantern slide cover glass 3¼ x 4 inches and bound with lantern slide binders[9].

Summary

The instructions given for the preparation of color transparencies of taper-sectioned and multi-etched metallographic specimens can only be general because most specimens differ in the combination of the metals present and require different treatments or precautions. However, experience in this field is readily acquired.

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[1]G. A. Lux and W. Blum, NBS Research Paper RP 1645 (1945), "Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings".

[2]W. L. Pinner, Proc Am Electroplaters' Soc. **28**, 136–144 (1940).

[3]A. T. Steer, "The Influence of Base Metal Surface on the Nature and Characteristics of Electrodeposited Metals", Trans Australian Inst Metals **2**, 17–32 (1949).

[4]Reversal Safety Color Film, DaylightType 3¼ x 4¼ inches, manufactured by Eastman Kodak Co., Rochester, N. Y.

[5]Photovolt Photomicrographic Exposure Photometer Model 514-M with cell C.

[6]Pure Water Absorption Cell plus Kodak Colour Compensating Gelatin Filter (lacquered) CC-40 Y 3 in (7.6 cm) square.

[7]Uncoated Zeiss Apochromats and Homal Negative Amplifiers.

[8]Radio-Mat, manufactured by Radio-Mat Slide Company Incorporated Manufacturers, Daytona Beach, New York, Philadelphia.

[9]Manufactured by Eastman Kodak Co., Rochester, N. Y.

DISCUSSION

MR. RALPH D. WYSONG (Studebaker Corporation, South Bend, Ind.): What etchant was used in preparing the specimens for the color slides?

DR. WESTMAN: For most of the sections that were shown, Dr. Mohrnheim indicated that 3 per cent Nital was used. Actually, he has spent some time working with mixtures of etchants so that he was able to develop the structure of the steel, the copper, and the nickel boundaries all in one section. That is a rather detailed subject—if you would care to write us, we would be glad to send you details on any of the sections shown.

DR. WILLIAM BLUM (Washington, D. C.): Reference was made to some of the plates that were used in the study of Lux and Blum. In the examination of those or any cold rolled steels did you run into evidence of any differences in structure and condition on the two sides of the piece of cold rolled steel prior to any polishing or etching?

We came to that conclusion in some of Strausser's work, where we used strips of cold rolled steel. One side would give consistently inferior deposits to those produced on the other side, although at the time our metallurgists were not able to discover any difference in the appearance or condition of the steel on the two sides. Have you observed that?

DR. WESTMAN: The only thing of that kind that we have observed to date is in connection with the steel sheets that are used for making tin plate. This was a purely geometrical condition; for some reason, one side of the sheet is smoother than the other side. We have not done any actual plating yet, and it may be that when we get around to plating specimens, we will run into the factors that you have described here. Certainly you can get a difference between two sides of a sheet as far as its roughness is concerned. Whether you can get other differences, I do not know. The point you have brought up is definitely interesting and we will keep it in mind in future work. It does indicate another case where the basis metal may have an effect on plating.

MR. LLOYD O. GILBERT (Rock Island Arsenal, Rock Island, Ill.): I would like to ask about the slide which showed the nodule in the chromium plate which was stated to have been a nodule which would come out later in operation. There seems to be a considerable void between the fragments or the nodule and the remaining portions of the plate.

Is there an actual void or is there an inclusion? What is your opinion concerning this?

DR. WESTMAN: The appearance of the section around that particular nodule is due to an actual cavity. In other instances we found an outline of a beautiful probability curve with no such cavity. I don't know the full history of this investigation—it was one done in the Department of Engineering and Metallurgy. It may be the cavity was due to corrosion attack. I know this was a very interesting case. Apparently there

must have been impurities in the solution that would disturb the chromium plate at a certain point; that disturbance then carried back along a more or less normal probability curve. In some cases there was no cavity; in other cases there was enough cavity so that the nodule came loose.

I think that if you write to our Director of Engineering and Metallurgy—I hoped he would be here today—he would be glad to tell you what he could about that particular investigation, especially if the company concerned would give him carte blanche to discuss it with you.

MR. GILBERT: I would like to mention, for the interest it might convey, that in some investigations on the functionability of chromium plated items we find that the ultimate failures under rather high stresses occur not at the interface, but within the chromium. This has been quite a baffling sort of situation in view of the fact that there was no apparent explanation for such failures. The nodule effect that you have shown may satisfactorily explain that type of failure.

MR. KLEM PETROSIUS (Nash-Kelvinator Corporation, Kenosha, Wis.): With reference to sample preparation of slides exhibited, was there any special reason why copper was chosen for the backing material?

DR. WESTMAN: I don't think there was any special reason. It was just a matter of using something to support the surface while we were polishing. Frequently we put on a bit of nickel, then copper on top of that.

MR. PETROSIUS: Have you used chromium as a backing?

DR. WESTMAN: I do not believe we have used chromium. One technique that I did not mention and which we are going to try out is the use of diamond dust. You saw those sections where you have an embankment effect due to the fact that some of the disturbed zones would not polish at the same rate as a coating. Now, it is claimed that you can get away from that effect by using diamond dust as an abrasive and we are just starting to try that now.

MR. PETROSIUS: Have you had any difficulty with the copper smearing over your steel surfaces that you want to examine?

DR. WESTMAN: No, I have not heard that discussed. I should mention that you cannot make sections such as I have shown by merely putting the specimen on a wheel and letting it go; it requires very careful hand polishing toward the end of the polishing process in order to get the effects that Dr. Mohrnheim has been getting. In fact, it has taken him two months to develop the technique to the point where he can get the nice, clear sections that I showed you this morning.

MR. PETROSIUS: That, then, would not be applicable to production preparation of samples?

DR. WESTMAN: Not if you are interested in exploring the little narrow zone between the basis metal and the plate. You have to be very careful how you polish in order to bring that out. I think if you review the papers of Dr. Steer in England, that you will find described in some detail more or less the same technique that we have used.

MR. FENNELL: What is the reason for mounting your specimens in copper rather than in Lucite or Bakelite?

DR. WESTMAN: These specimens actually are mounted in Lucite, but, since Lucite does not give the protection to the plate that you need, we plated with copper or nickel before mounting.

MR. FENNELL: Bakelite, we find, is quite a bit harder than Lucite. Would that be satisfactory?

DR. WESTMAN: I do not believe we tried that. It might be quite satisfactory.

MR. FENNELL: Do you recommend that buffing prior to plating be avoided wherever possible on either or both: (1) the base metal and (2) the preliminary copper underplate, if utilized?

DR. WESTMAN: If we knew an exact answer to that, we could stop our Project here and now. One thing we get from the literature and our examinations to date that every one seems to agree on pretty well is that the less you disturb the basis metal, the better. On the other hand, as you saw on some of these sections, there was a perfectly good nickel plate on copper that had been very decidedly disturbed for a considerable thickness and also you find other good plates on steel that have been disturbed.

I think that whether the disturbance causes trouble or not is still an open question, but it does seem logical, where you can do it, to disturb the sheet as little as possible when you receive it from the mill. It seems the rolling mill can produce a smooth surface with less disturbance of the metal than you can obtain by other methods except possibly electropolishing, which we have not yet investigated.

MR. FENNELL: It is fairly general practice, when a really lustrous nickel-chromium plate is desired, to polish the preliminary copper underplate even though you may already have an excellent base metal finish. Do you find that it is less objectionable to polish this copper plating rather than the base metal since the former is softer?

DR. WESTMAN: We haven't had enough experience to give you a definite answer to that. We only know that strongly buffed copper surfaces apparently are not giving trouble in the limited number of specimens that we have investigated.

MR. FENNELL: Which type of steel have you found to be preferable for (1) ease of preparation prior to plating and (2) adhesion of plating: rimmed, semi-killed or killed?

DR. WESTMAN: That is another basic question. As far as this Project is concerned, all we know is that these different steels are being used commercially. Which is preferable, I don't know. That is one of the questions we hope to answer.

MR. FENNELL: Am I correct in assuming that you were interested primarily in producing representative

plated samples of each of the above and presenting your results and experiences in so doing without making definite recommendations as to their relative merits?

DR. WESTMAN: We are anxious to find out whether there is any real difference from the electroplater's point of view.

MR. FENNELL: But you have not established that yet?

DR. WESTMAN: No.

MR. FENNELL: I assume the answer would be the same to an inquiry concerning the effects of the method of killing (i. e., silicon killed vs. aluminum killed) on "plateability"?

DR. WESTMAN: Yes, that would come into the same category.

MR. FENNELL: You have not established that either?

DR. WESTMAN: No.

MR. FENNELL: Have you established any definite relative performance between low, medium and high carbon steels in (a) the annealed and (b) hardened condition.

DR. WESTMAN: Those are all questions to which we might have an answer some time. We are just getting started on this Project and if you do run into any situations where you feel there is a demonstrable difference we would be most happy if you would bring it to our attention, because we are starting work in a field where a number of people think there are no differences between these different steels;that if the plater knows his job and uses the right cleaning cycles, he is all right. Maybe that theory is all right, but on the other extreme, you have people like Dr. Steer who attribute all plating difficulties to the disturbance of the plating surface of the metal.

There is some indication in the literature that these different steels react differently in the polishing process, and also give you a different effect, therefore, in your plate. But, I think these are all questions which we hope to be able to solve at some future date.

MR. FENNELL: This part of my question I believe you can definitely answer. We were once given the assignment of finding whether or not there were any outstanding differences in performance or longevity between springs tempered by cold working versus those hardened by heat-treating methods. We ran numerous fatigue tests and came to the conclusion that one was as good as the other in fatigue resistance and length of service. Although it is well to avoid it wherever possible, sometimes springs have to be plated. In such instances, am I correct in assuming that you would probably prefer to plate heat-treatment hardened springs rather than cold work hardened springs, assuming that our previous tests results were valid and the only difference is that of surface condition or disturbed metal.

DR. WESTMAN: I don't think I would have any recommendation to make on the basis of what we have done so far.

MR. FENNELL: You certainly would have more disturbed surface metal when a piece of steel was hardened to spring temper by cold working (rolling, hammering, etc.).

DR. WESTMAN: Yes, you would have more disturbed metal. On the other hand, the heat-treated spring might happen to have a lot more stresses in it.

MR. FENNELL: Practically all heat-treated springs are first fully hardened (quenched) and then drawn (tempered) to spring hardness. The drawing operation automatically relieves any stresses.

DR. WESTMAN: Quoting from the literature, not from our own results, if you take high carbon steel, and already have it stressed so that it is on the verge of cracking, then even the temperature changes and contacts with hydrogen you may get in the plating process may be just the last straw that makes the steel crack and, of course, if it cracks, your plate is cracked.

I think Mr. Pinner wanted to reply to one of your questions.

MR. PINNER: I would appreciate the opportunity of clarifying a part of this discussion and more specifically that which has to do with the advisability of buffing copper.

I realize that in the presentation of my paper last Tuesday I stated that it was desirable to do as little work as possible on a good cold rolled piece of steel, if one wished to obtain superior quality. In making this statement, I had in mind the avoidance, as far as possible, of operations such as drawing, stretching, bending and abrasive metal polishing. I did not, however, mean to imply that buffing of the steel with an extremely mild abrasive was damaging. As a matter of fact, it is an opinion that buffing of steel or buffing of an underlying plated metal is very desirable. It is my belief that a buffed base metal or a buffed undercoat provides for the deposition of an improved top layer from the standpoint of smoothness and corrosion resistance. In this regard it is pertinent to mention two sets of panels which have been on exposure for about six years in conjunction with the weather exposure tests being carried out by Committee B-8 of ASTM. These two sets of panels involved the plating of nickel which was buffed, or buffed and annealed and then followed by a second coat of nickel which was also buffed and then chromium plated. Comparing equal thicknesses of any other combinations of nickel or copper and nickel plate, these two sets of panels are markedly superior from the standpoint of the protection of the base metal against rusting. Apparently the immediate buffing operation conditioned the original nickel plate so that it received a better top coat from the standpoint of porosity or points of potential galvanic weakness. It would be desirable if we understood thoroughly the means by which we could condition steel or a copper undercoat so as to achieve the same result.

Let me again emphasize, as far as this particular discussion is concerned, that in my opinion buffing of an undercoat of copper is desirable.

PROGRESS REPORT ON DEVELOPMENT OF A NEW ACCELERATED CORROSION TEST*

W. L. PINNER†

This project had its inception in growing dissatisfaction with the salt-spray test as a means of evaluating the serviceability of decorative plated coatings. Industry has recognized the difficulty of duplicating results from one salt-spray box to another, as apparently there are unrecognized factors which cause wide variation in results. Additionally the salt-spray test, as presently used, does not duplicate the types of failure encountered in actual service and it is obviously desirable that an accelerated test should accomplish this.

In 1951 a group, under the Chairmanship of Mr. F. L. LaQue, was appointed by the Research Committee to determine the advisability of action. The report of this Advisory Committee has been published in PLATING[1]. For easy reference a few pertinent passages of it are reviewed as follows:

1. It was recommended that the salt-spray test, as presently employed, should be modified or replaced.
2. It was further recommended that the AES Research Committee should establish a project to accomplish this purpose.
3. It was suggested that the program should start by studying the performance in test and in service of decorative plated coatings over steel, in terms of their behavior under conditions represented by use on automobiles in Detroit during Winter months.
4. It was recommended that a task group secure an accurate description of the nature of the environment which causes deterioration of decorative plating in Detroit during a typical Winter.
5. It was proposed that such information would be desirable as a guide to the selection of a useful accelerated testing medium.
6. It was proposed that exposure test panels of the Hull Cell type, covering gradations of thickness, would likely be useful in such a program.

The foregoing constitutes the basis of the program which Project 15 is rather faithfully following. The reader of this manuscript, however, is urged to review the complete report of Mr. LaQue's Advisory Committee for additional clarification.

Project 15 is unique in a number of respects, when compared with the organization and procedure followed by other projects which are, or have been, sponsored by the AES Research Committee. It is unique first as far as the project committee itself is concerned. In contrast to other such committees, there is as yet no project director, as such, nor is there an undergraduate Fellow carrying out the experimental work. The purpose of the Project is so important and the need for speedy action is so acute that activities are being contributed by several companies, whose representatives form the project committee. Appended to this report is a list of fifteen top-flight technical men, representing thirteen companies participating in the actual work. These men form the Project Committee, agree upon the course of action, and then see to it that the actions required are carried out in their respective plants and laboratories.

Project 15 is unique in that its support, financially, is very largely derived from the companies that its committee members represent, inasmuch as the expense for carrying out the work would be far beyond a sum appropriate to be expended from the limited funds available from the Research Committee. It is pertinent to mention that this expense in no single instance has affected the support which these companies otherwise provide to the Research Committee for its other activities. The organizations involved and their representatives are more than glad to contribute their time and expense, with the hope that results from the project will be forthcoming at as early a date as possible.

In keeping with the recommendations of the Advisory Committee, Project 15 has accepted as its three principal starting assignments; first, the design, fabrication and service exposure of plated parts; second the gathering of pertinent data on conditions thought to contribute to the deterioration of plated coatings,

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and third the carrying out of exploratory accelerated corrosion tests in order to select qualitatively those which appear to have merit and which should be investigated quantitatively at a later date.

While the Advisory Committee suggested the studying of the performance of decorative plated coatings over steel, the project committee agreed that these studies should be supplemented by similar ones involving such coatings on diecast parts. Service tests are therefore planned on both materials and, for purpose of illustrating the extent of the cooperative effort, the assignments involved in this phase of the program shall be listed.

First of all it is pertinent to mention that the designed test parts will resemble front license plates and will be exposed on the front license plate brackets of cars in Detroit, there, very fortunately, being no numbered plates required in this location in the state of Michigan.

For the handling of the diecast parts the following assignments were made and are partially completed: General Motors Corporation agreed to furnish the diecast dies, cast the parts and store the dies for future use. Packard Motor Car Company agreed to polish the parting line and buff the parts ready for plating. Doehler-Jarvis Company is to inspect the parts, plate them with an appropriate copper-nickel-chromium plate and package them for shipment. Chrysler Corporation will store excess parts not in use and will attend to the installation of them on taxicabs and other test cars.

As for the handling of the steel parts the following should be noted: Hudson Motor Car Company designed and furnished the necessary dies; Kaiser-Frazer Corporation furnished the raw material, formed the parts and assembled the necessary brackets by projection welding; and the Udylite Corporation agreed to polish the steel and round the edges preparatory for plating and to store the parts.

Two types of plating will be applied to the steel parts, one consisting of straight nickel followed by chromium, the other consisting of a combination copper-nickel plate followed by chromium. The Electric Auto-Lite Company will nickel plate, buff and chromium plate part of the steel pieces. The Ford Motor Company will copper plate, buff, bright nickel and chromium plate the other part of the steel pieces. Chrysler will store excess parts not in use and attend to their installation on mobile test sites. The entire committee will attend to the inspection, photographing and carrying out of any laboratory work involved in connection with the exposure specimens. As one other necessary assignment, the Udylite Corporation has made an extensive study of racking methods necessary for the production of a tapered section plate as recommended by the Advisory Committee.

It may be reported that this phase of the program is well under way, with virtual assurance that the parts will be ready for exposure prior to the Winter months of 1953–1954.

In conformance with the suggestion of the Advisory Committee, it is presently planned that the test panels will have a total thickness of metallic coating varying from about 0.0004 inch, at one end, to 0.0016 inch at the other end. In the foregoing it will have been noticed that the steel parts will be coated with two types of coating, one being all-nickel and the other being a combination of copper-nickel. It is important to mention that the variations in thickness and the use of different types of coatings is definitely not designed to compare the serviceability of the plate as a function of these factors, because such matters do not fall within the scope of this project. Rather the purpose of variations in thickness is to provide coatings which will fail at early dates and at dates after longer periods of exposure. The different types of coatings were selected because these are in widespread use in industry. It is necessary to remember that the entire purpose of this phase of the program is to obtain the types of deterioration which occur under known conditions, so that efforts may be made later to obtain exactly these same kinds of deterioration by accelerated means.

Presently it is planned to provide about 1000 panels of each of the three categories. While the exact distribution has not been arrived at, it is probable that not more than one-half of each kind will be subjected to service exposure. The balance of the panels will be carefully stored to be used at a later date in experimental work, when accelerated means will be sought which will duplicate the exact types of service failures.

The second phase of the program involves the gathering of all pertinent data which are known, or suspected, to contribute to the deterioration of plated coatings. The most pertinent data will, of course, be gathered during the time of exposure of the test panels. However, prior to that time, the Project is obtaining data and to this end it has enlisted the cooperation of certain departments of the city of Detroit, of which there may be mentioned, for example, the Weather Bureau and the Department of Parks and Boulevards, the latter of which will keep the Project supplied with information regarding the amount and locations of materials used for de-icing streets. Additionally the Project is maintaining liaison with certain groups which have allied interests and it may point, for example, to a recent attendance at a Joint Industry Conference which considered details of a Detroit area air pollution study. Furthermore, the Project has drawn on information already in the files of certain committee members, who have for considerable periods of time gathered information on various factors in the air and on the city streets, all thought to contribute to the general picture. Still further, certain committee members have arranged the installation of collector bottles, mounted on automobiles, for the collection of street and air contaminants so as to determine the percentage and kinds of ingredients which may be picked up on automobile parts and thus cause corrosion to occur.

The third phase of the program involves the carry-

ing out of exploratory accelerated corrosion tests in order, at a later date, to select those which appear to merit further investigation. The committee recognizes that a great number of factors are involved in the mechanics by which corrosion occurs on plated parts. These are numerous and, to mention a few, the committee will take due recognition of the effect of abrasion from dirt particles, salt, moisture, and high acid content of slush on the street following a snowfall or any condition leading to ice formation. The committee recognizes that in the air, rainfall itself is damaging, especially the first part of a rainfall, which in scouring the air carries down considerable quantities of corrosive chemicals.

As the first step in this part of the program, various committee members volunteered the use of various types of testing equipment, including humidity cabinets, intermittent immersion test equipment, cold cabinets, salt spray boxes, total immersion tanks and other similar equipment. There followed the appointment of a subcommittee which solicited ideas from all of the members of the main committee as to the types of test which should be preliminarily looked at. The ideas accepted by the subcommittee and subsequently specifically assigned to committee members for experimental investigation are listed as follows:

1. The carrying out of tests at temperatures lower than those normally used in salt-spray tests and approaching the temperatures likely to prevail when roads are treated with salt during winter months when corrosion is believed to be most severe. This should include admission of corrosive gases such as sulfur dioxide which change in solubility with temperature.
2. The continuous immersion of test specimens in solutions made up to represent what might be encountered in service.
3. Tests in which the specimens would be immersed in solutions of appropriate composition and then exposed to a humid atmosphere with or without the admission of corrosive gases in a cycle of immersion and atmospheric exposure.
4. Tests in which the specimens first would be chilled, then sprayed with an appropriate solution simulating early rain containing dust in suspension and then returned to the chilling chamber for further exposure.
5. Modifications of the standard and acetic acid modified salt-spray test, such as:
   (a) Intermittent operation
   (b) Substitution of oxygen or carbon dioxide, or both, for air in the spray
   (c) Adjustment of *p*H by acids other than acetic—e. g., sulfurous
6. Addition to the test environment of solid particles such as ash, dust and soot (carbon).
7. Use of a gelatin film as a reservoir of corrosive media, but especially as a means of holding solid particles and corrosion products in contact with the metal while it is being subjected to attack in a spray or other corrosive environment.
8. Expose specimens to a moist atmosphere carrying sooty smoke from a high sulfur fuel (coal or gas) so that surfaces will become contaminated followed by further exposure to a moist atmosphere.
9. Explore effects of temperature between freezing point and some higher temperature on the galvanic potential relationships amongst basis and coating metals.
10. Explore effect of addition of wetting agent to favor penetration of corrosive media into fine pores or cracks.
11. Examine coated specimens with respect to the amount of current required to prevent corrosion in an appropriate testing solution such as sodium sulfate adjusted to proper *p*H or in a solution collected from Detroit streets after treatment with salt in winter or simulation of this.
12. Miscellaneous proposals
    (a) Eliminate positional effects in spray boxes by moving specimens or nozzles, or both.
    (b) Investigate effects of oxidizing agents other than air in promoting breakdown of coatings in appropriate media.
    (c) Investigate water-line effects in connection with immersion tests.

Some results from the preliminary investigations already have been made available in reports which would require many additional pages to cover. These results would more appropriately be contained in detail in the Project progress reports, normally published in PLATING. It is sufficient to say that the experimental work thus far has eliminated certain chemicals found in the atmosphere or on the streets and at the same time has definitely assigned corrosion of plated parts to certain other chemicals which through their existence in road dirt or in the air can cause corrosion. Illustrative of the type of test which is being carried out, a section of a report of one committee member is quoted as follows:

"Tests were conducted on 4 x 6 inch plated panels (0.001 inch nickel over NAX steel polished to 10 profilometer) with solutions thought to represent a possible early rain in a mingled industrial atmosphere. An extension of this work concerned the corrosive nature of chemicals of several types on nickel electrodeposits.

A synthetic industrial water wash was made of ingredients commonly regarded as atmospheric contaminants. The mixture was composed of ammonium chloride (0.020 g/l), sodium sulfite (0.020 g/l), ammonium nitrate (0.020 g/l), zinc oxide (0.020 g/l) and powdered pumice (0.020 g/l). It is recognized that fumes of some of these salts cannot be washed out of air with any degree of effectiveness but might be carried as precipitants in showers.

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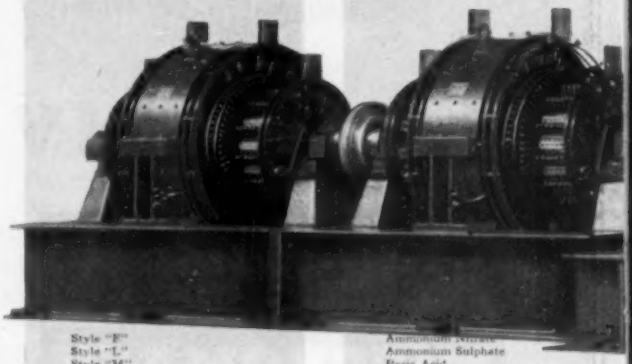

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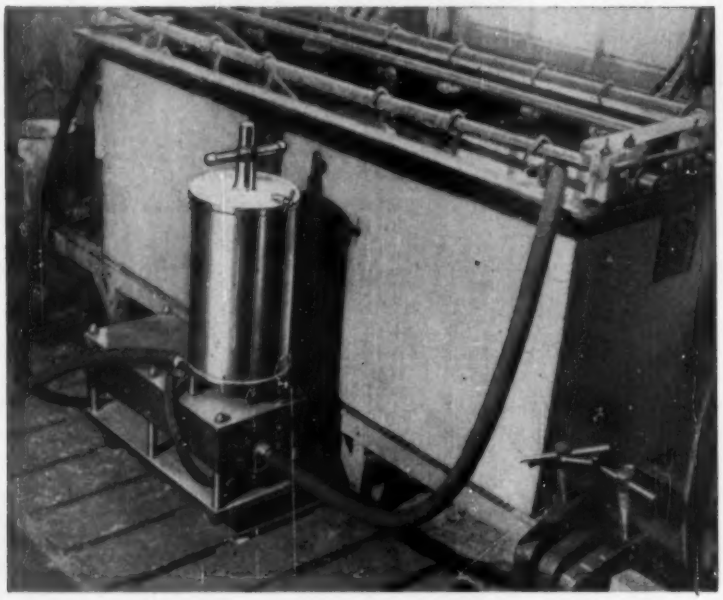

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outside to permit condensation did not show any evidence of attack on nickel coatings. Contrarywise, other panels, placed in a humidity box, 100 per cent at 100° F, showed rapid rusting at isolated points. It was realized that not all ingredients of the 'early rain' necessarily contributed to this corrosive effect and the constituents were checked individually. Panels, bordered with a thin coating of silicone lubricant or a line drawn by a grease pencil to permit retention of fluid, were flooded with aqueous solutions of varying concentrations and allowed to stand at room temperature. Solutions of 1 g/l of sodium sulfite and ammonium chloride rapidly perforated the nickel coatings and in 14 hours caused extreme rusting. The corrosive action present in the early rain was therefore assigned to the ammonium chloride and the sodium sulfite.

A number of other common industrial salts then were tried in much the same manner, with individual panels being subdivided to eliminate plating variations. Table I lists the results obtained.

It can be reported that each corrosive salt is different in its mode of destruction and has a different optimum of physical conditions under which it is most effective as an agent of nickel corrosion. Inhibition of a corrosive ion by another is possible. Wetting agents seem to be effective in reducing even the electrolytic corrosion of nickel, especially at low potentials (less than 0.5 volts).

The conclusion is that some chemicals that are present and are washed out of industrial atmospheres are so corrosive to nickel that they cannot be satisfactorily used to test the value of nickel plates other than in regard to the efficacy of thickness as a means of preventing penetration to the base metal. The effects of inhibitory ions and physical conditions point to causes of irregularity in salt spray results without regard to the possibility of highly corrosive contaminants such as the sulfite anion and ammonium cation".

TABLE I. RESULTS OF CORROSION TESTS USING COMMON INDUSTRIAL SALTS*

Nickel chloride—very severe perforation at room temperature
Sodium metabisulfite—solution of plate accompanied by perforation
Sodium tartrate—no effect
Sodium chloride—mild perforation at strong concentrations (20 g/l)
Potassium pyrosulfate—extreme solution of nickel, very fine perforation
Potassium iodide—strong attack on the nickel at many small points without perforation
Potassium iodide plus ammonium chloride—acts as potassium iodide alone
Ammonium sulfate—attack only when dried and placed in humidity chamber, strong perforation
Sodium acetate—no attack under any test condition

*NOTE: By perforation is meant spots of red rust.

As noted in the foregoing, detailed information on the preliminary tests may be published at a later date, as seems advisable and at the discretion of the Research Committee.

The purpose of this report has been to outline the types of programs in progress and generally to report the status of the Project. The committee would welcome suggestions from any of the Society membership as to further types of accelerated tests which might be considered.

This report is rendered on behalf of the Project 15 Committee by its Chairman.

REFERENCE CITED

[1]Plating 39, 65 (1952).

ADDENDUM

AMERICAN ELECTROPLATERS' SOCIETY

PROJECT 15 COMMITTEE

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Hudson Motor Car Company

MR. WILLIAM STERICKER (Philadelphia Quartz Company, Philadelphia, Pa.): In London they have found that a good proportion of the sulfur fumes are in the form of sulfur trioxide rather than sulfur dioxide. We have also found that in this country in connection with some laundry work where the clothes were dried outdoors, even in residential districts. Have you run any tests for sulfuric acid in rainfall?

MR. PINNER: I am quite sure that we have run such tests. Unfortunately, however, I do not have the data with me and therefore I am unable to give you specific information. You may recall also that in our accelerated tests we planned the inclusion of both sulfurous and sulfuric acid in the test medium.

● ● ●

Statistical Quality Control

GLOSSARY OF TERMS

ACCEPTANCE NUMBER
Acceptable number of defectives found in a sample or series of samples from an inspection lot.

ACCEPTABLE QUALITY LEVEL (AQL)
The economical quality level which when established permits the acceptance of 95 per cent of submitted inspection lots having a quality level equal to or better than the acceptable per cent defective.

A DEFECTIVE
An item containing one or more defects.

ASSIGNABLE CAUSE
A factor contributing to the variation in quality that it is possible to identify.

AVERAGE (INDICATED THUS $\bar{X}$ AND READ X BAR OR BAR X) The total of two or more values divided by the number of values used.

AVERAGE OUTGOING QUALITY LIMIT (AOQL)
The maximum average per cent defective present in the overall accepted product, including lots accepted by the plan plus rejected lots that have been cleared of defectives by 100 per cent inspection.

AVERAGE RANGE (INDICATED $\bar{R}$ AND READ R BAR OR BAR R)
The total of two or more range values divided by the number of ranges.

CHANCE CAUSE
A factor responsible for variation in quality that cannot be identified or controlled.

DEFECT
A failure to meet a requirement imposed for a particular characteristic of a unit. The characteristic may or may not be measurable.

GRAND AVERAGE (INDICATED $\bar{\bar{X}}$ AND READ X DOUBLE BAR OR DOUBLE BAR X)
The total of two or more averages obtained from equal size groups, divided by the number of averages.

HISTOGRAM
A diagrammatic picture of a group of values.

INSPECTION LOT
The number of items to be accepted or rejected on the basis of a sampling plan.

LOT TOLERANCE PER CENT DEFECTIVE
Sampling plan that permits the acceptance of individual lots having a quality level no worse than a stated per cent defective.

LOWER CONTROL LIMIT (LCL)
The limit established, generally three standard deviations below the average value.

NORMAL FREQUENCY DISTRIBUTION
The normal grouping of items either side of a central line or average value when influenced by chance causes only.

NORMAL INSPECTION
The level of inspection initially introduced for a particular product or supplier which will maintain a particular AQL.

NUMBER DEFECTIVE "M" CHART
The graphic record of the number of defective items found in each lot of a series of inspection lots.

NUMBER OF DEFECTS "C" CHART
The graphic record of the number of defects per unit found in a series of units.

PER CENT DEFECTIVE "P" CHART
The graphic record of the per cent of defective items found in each lot of a series of inspection lots.

PROCESS AVERAGE
Average percentage of defective items in the first samples from inspection lots.

PROCESS INSPECTION
Study of process, including a periodic sample check of product at various stages of production.

RANGE (R)
The difference resulting from the subtraction of the smallest value from the largest value in a group of two or more values.

REDUCED INSPECTION
Inspection under a sampling plan that will maintain the desired AQL for normal inspection, but requiring a smaller amount of inspection as a result of improvement in the process average.

REJECTION NUMBER
The number of defectives found in a sample or series of samples that requires rejection of the inspection lot.

SAMPLE SIZE LETTER
Letters from "A" to "O" representing the sample size, depending upon the inspection level and the lot size. The value of a sample size letter varies between single, double, and sequential plans.

STANDARD DEVIATION
The measure of variation either side of the arithmetic mean or average.

project no. 2

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Acknowledgment is due the Research Committee, Dr. Donald Price, Oakite Products, Inc., Chairman; the Research Directing Sub-Committee, Mr. Walter Pinner, Houdaille-Hershey Corporation, and Mr. George Jernstedt, Westinghouse Electric Corporation, Chairman and Supervisor, respectively; and the Project Committee, Dr. Walter R. Meyer, Enthone, Inc., Chairman, and Mr. Robert A. Ehrhardt, Bell Telephone Laboratories, Mr. George Best, Mutual Chemical Company of America, and Dr. W. D. Hatfield, Decatur, Ill., for their contributions to this project.

* AUTHOR

THE ANALYSIS OF ELECTROPLATING SOLUTIONS FOR MAJOR CONSTITUENTS*

Introduction

Prior to the author's activities as Vice-Chairman, Research of the AES Research Committee, he was intimately associated as Project Director with the work of AES Project 2. This project was inaugurated in 1945 at Princeton University and was later transferred to the author's direction at Lehigh University where the work has consisted of the development of analytical methods for the determination of trace impurities in electroplating solutions. During the summer of 1951, after the Project had completed the work on 27 elements in copper, nickel, and zinc plating baths, the Research Directing Subcommittee decided to broaden the scope of Project 2 to include the development of analytical methods for the determination of small quantities of metal and non metallic constituents in plating wastes.

Through the activities of the Ohio River Valley Water Sanitation Commission, a joint sponsorship of Project 2 was effected for a period of a year and a half. During this time Dr. R. F. Muraca and the writer with the aid of several assistants developed, compiled, and tested a series of 18 specialized analytical procedures for the determination of trace constituents in electroplating or metal finishing waste materials. The final report on this project will be issued eventually by the ORSANCO in the form of a handbook for the control of plating wastes. Each of the analytical procedures developed and tested by the industries under this project will be published individually in Plating.

At the conclusion of the ORSANCO project in January of 1953 a research committee of the AES discussed the advisability of reactivating Project 2 under the sponsorship of the AES Research Committee. The purpose of this reactivation was to study the available analytical methods now used for the determination of major constituents of electroplating baths. The purpose of the study of macro-analytical methods was manifold. Primarily, however, it was expected that the project director would evaluate the presently available analytical methods from the standpoint of simplicity, accuracy, time, and cost per determination. It was proposed at that time that these methods be extended by carrying out research on certain methods of analyses in the hope of developing new simple specialized proce-

* Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 18, 1953

TABLE I. FACTORS CONSIDERED IN ANALYSIS

1. Personnel Training	5. Accuracy and Precision	8. Effect of Impurities
2. Lab Facilities		9. Quality of Sample
3. Apparatus and Instruments	6. Frequency	10. Cost vs. Value of Results
4. Time	7. Number of Determinations	11. Control Method Used

TABLE II. ANALYSIS OF NICKEL BATHS (MAJOR CONSTITUENTS)

1. Nickel	3. Chloride	5. Boric Acid	7. Ammonia
2. Cobalt	4. Sulfate	6. Magnesium	8. *p*H

dures which the plater might be able to use for the control of his plating baths. The AES Research Committee recommended that the entire results of this program should be collected into a single publication which might serve as a platers' "Handbook for Solution Control".

Although Project 2 has not as yet been reactivated along the lines proposed by the Research Committee a fair start on this program was begun under the writer's direction during the earlier period of Project 2's operations. In this brief paper it is proposed to outline the factors which are considered important in the Project 2 study of macroanalytical methods as well as to tabulate briefly the major conclusions which were reached in the Project's testing and compilation of the macro methods of analysis now available to the plater. Further, it is proposed to outline briefly in principle only two new specialized methods of analysis which the Project has developed during this work, namely: the determination of boric acid, and the determination of alkali hydroxide in cyanide plating baths. Project work to date covers the study of the macroanalytical methods for the determination of substances present in nickel and copper plating baths only. Extensions of this work will be made during the reactivation of Project 2 which, it is expected, will proceed normally around September, 1953.

Factors To Be Considered in Solution Control

When in the course of a plater's or electrochemist's work he finds it necessary to control his solutions by analytical chemical means, ordinarily he refers to the literature or presently available techniques of analysis. Here he is usually confronted by a series of methods of analysis for the same constituents (for example, nickel in a nickel plating bath) and frequently he finds that not any of these methods were especially adapted for his particular plating solution. The plater is faced with the problem of selection of analytical methods for which he is frequently not specially trained.

In the work in Project 2 involving the study of these macroanalytical methods, a number of factors were taken into consideration during the testing and compilation of the various methods available for a single specific constituent. A number of these factors are tabulated below in Table I.

In each of the methods of analysis which the author proposes to submit, the various factors tabulated above have been considered. Thus for example, in the determination of nickel in nickel plating baths at least four equally good methods for the determination of nickel are available and will be presented. Annotations with each method will be presented in order that the reader may select judiciously, with due regard for his requirements, insofar as accuracy, time facilities, etc., the particular method which most nearly suits his purpose. Evaluations of each of the methods which the author proposes to present for the determination of major constituents in plating baths, have been made with a view towards presenting the plater with simple, rapid yet precise procedures suited to the platers' special needs.

Analysis of Nickel Plating Baths

In the control of nickel plating baths there are eight major constituents for which analyses are commonly made in addition to the twelve or fourteen trace impurities for which specialized methods have already been published. These eight constituents are tabulated on the following page.

Research has been completed on the 8 methods tabulated above insofar as the study and compilation of the details of the methods presently available are concerned. The Project testing program on each of these methods has been completed and it is expected that a number of these specialized procedures will be published in Plating. In a review paper of the type presented here, it is not proposed to present details of the various procedures available for the determination of nickel, sulfate, chloride, etc. The author shall, however, present summary information concerning the various methods which were studied and which he hopes to present in detail at another time.

For example, in the analysis for nickel in nickel plating baths gravimetric, volumetric, and colorimetric methods are available. Several modifications of each of these three techniques have been published with particular regard for the determination of nickel in plating solutions. The author has investigated each of these methods and has adapted several for the specific impurities found in electroplating baths. A brief summary of certain of the factors considered in this study is shown in Table III.

TABLE III. ANALYSIS OF NICKEL BATHS
(SUMMARY OF NICKEL DETERMINATION)

Method	Per Cent Relative Error	Speed of Determination	Ease of Determination	Accuracy
Gravimetric	0.1	Slow	Fairly difficult	High
Volumetric	1.1	Rapid	Easy with practice	Good but cobalt included
Colorimetric	2.5	Very rapid	Easy	Fair

An examination of this table shows that a colorimetric method for the determination of nickel may be carried out very

easily with a minimum of skill on the part of the operator and that a result may be obtained in a very short time. On the other hand a colorimetric method for the determination of nickel yields a result which is only precise enough for routine control. Furthermore, it may be noted that the facilities required for the colorimetric determination of nickel involved the use of a specialized colorimeter not generally available in the plating shop. Selection of the method to be used for the determination of nickel in nickel plating baths depends therefore upon the use to which the chemist wishes to put the results as well as to a series of other factors described previously.

A summary of the observations which were made during the study of the determination of sulfate content of nickel plating baths is given in Table IV.

Here it is noted that at least four methods for the determination of sulfate in nickel plating baths are available, each of which presents certain advantages and disadvantages depending upon the requirements of the analysts and of the process to be controlled.

The analysis of nickel plating baths for chloride content again present at least three available methods for the determination of chloride. A summary of certain comments and annotations made during the Project study of these methods is shown in Table V.

It is to be noted here that the Volhard method for the determination of chloride, infrequently used by platers, is to be recommended for its speed, ease of determination and small error.

Analysis of Copper Plating Baths

In addition to the study of trace constituents present in copper plating baths, the Project has completed the major portion of a study of the available methods for the determination of common macro constituents in copper plating baths. These are tabulated in Table VI.

It is to be noted that analytical procedures are to be presented for both cyanide and acid copper plating bath constituents. In the near future the Project proposes to investigate analytical procedures for major constituents in other complex type copper baths.

Although there are several methods for the determination of copper in copper plating baths in both cyanide and acid, proper selection of a particular method can be made readily from the annotations made during the Project study of the available methods. As shown in Table VII the specific gravity or iodometric procedures may be selected if rapid results are required. On the other hand precision results for the determination of copper content of plating baths may be obtained in a longer period of time with more complex apparatus if the electrolytic procedure to be published is selected.

TABLE IV. ANALYSIS OF NICKEL BATHS (SULFATE)

Method	Sulfate*	Per Cent Relative Error	Speed	Ease	Accuracy
Gravimetric	0.1203	±0.1	Very Slow	Difficult	High
Volumetric $BaCrO_4$	0.122	± 2	Rapid	Easy	Good
Modified $BaCrO_4$	0.128	± 7	Rapid	Fairly easy	Low
Kocour	0.125	± 4	Very Rapid	Easy if precautions taken	Satisfactory

*Values given in g/ml

TABLE V. ANALYSIS OF NICKEL BATHS (CHLORIDE)

Method	Per Cent Relative Error	Speed	Ease	Accuracy
Gravimetric	0.1	Slow	Fairly easy	High
Mohr with Variations	−4.1 to +0.8	Fairly rapid	Difficult end point	Fair
Volhard	±0.25	Same	Very easy	Good to high

TABLE VI. ANALYSIS OF COPPER BATHS (MAJOR CONSTITUENTS)

Cyanide Bath		Acid Bath
1. Copper	3. Alkali Hydroxide	1. Copper
2. Carbonate	4. Cyanide (a) Free (b) Total	2. Sulfuric acid

TABLE VII. ANALYSIS OF COPPER BATHS (COPPER)

Cyanide Bath	Acid Bath
A. Iodometric ±0.5%, 20 min.	(A) Specific Gravity ±2%, 10 min.
B. Electrolytic ±0.1%, 100 min.	(B) Iodometric ±0.5%, 15 min.
	(C) Electrolytic ±0.1%, 60 min.

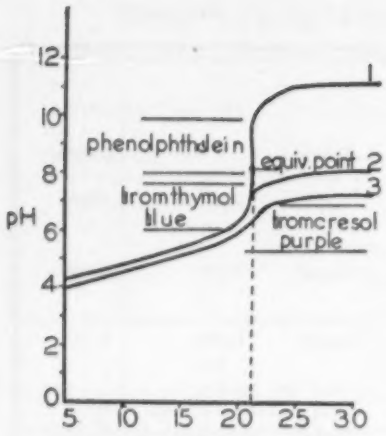

Fig. 1. Curve 1. Boric acid-sodium hydroxide titration curve when nickel is absent

Curve 2. Boric acid-sodium hydroxide titration curve in presence of 0.5 g $NiCl_2.6H_2O$

Curve 3. Boric acid-sodium hydroxide titration curve in presence of 2 g $NiCl_2.6H_2O$

Special Macro Method Developed For The Plater

Since many of the methods now in the literature for the determination of major constituents in solutions have not been particularly adapted for plating solutions, it has been the special province of Project 2 to attempt to develop specialized methods for the plater wherever necessary. A few of these methods have been developed to date and in fact one of these methods (boric acid) has been published in Plating[1]. It will not be possible to outline these procedures in detail at this time; however, a brief summary of the principles of the two determinations will be presented in summary form.

The Determination of Alkali-Hydroxide in Cyanide Copper Baths

The usual procedure, as carried out by many platers, for the determination of free hydroxide in cyanide copper plating baths involves the titration of the alkali hydroxide with standard acid to the color change of an indicator such as tropeoline (*p*H 12.1). This titration of alkali to an arbitrarily selected *p*H value does not yield the true value for the hydroxide concentration present in the copper bath as a result of added hydroxide. Equations I, II, and III below show that hydroxide ion in copper plating baths may result from three sources, viz.: the hydrolysis of potassium cyanide, the hydrolysis of sodium carbonate and the hydrolysis of added caustic alkali (KOH).

$$\text{I.}\quad KCN + HOH \rightleftharpoons HCN + K^+ + OH^-$$
$$\text{II.}\quad Na_2CO_3 + HOH \rightleftharpoons NaHCO_3 + Na^+ + OH^-$$
$$\text{III.}\quad KOH \rightleftharpoons K^+ + OH^-$$

It is assumed in the ordinary titration utilizing tropeoline as indicator that only the alkali added to the bath (Equation III above) is titrated.

It is well known by those operators who have attempted to utilize tropeoline that this particular titration is exceedingly difficult to carry out. The results obtained frequently are not worth the effort because of the difficulty of duplicating endpoint with this indicator. Accordingly, the Project has attempted to develop and will publish shortly a specific method for the determination of alkali hydroxide in cyanide plating baths.

Since one is interested in determining the alkali hydroxide present in the plating bath as a result of the addition of caustic alkali, any method developed for this determination should prevent the hydrolysis of potassium cyanide and sodium carbonate present in the bath. The method which the Project proposes prevents the hydrolysis of cyanide and carbonate by the precipitation of these constituents with silver nitrate and barium nitrate respectively as shown in equations IV and V listed below.

$$\text{IV.}\quad 2KCN + 2\,AgNO_3 \rightarrow Ag\left[Ag(CN)_2\right] \downarrow + 2KNO_3$$

$$\text{V.}\quad Na_2CO_3 + Ba(NO_3)_2 \rightarrow BaCO_3 \downarrow + 2NaNO_3$$

Thus, in the procedure for alkali cyanide which is proposed, a sample of the plating bath is treated with a slight excess of silver nitrate and barium nitrate solution (sufficient for complete precipitation of all cyanide and carbonate). Without filtering the solution, phenolphthalein indicator is then added and the alkali hydroxide is titrated with standard sulfuric acid in the usual manner. Inasmuch as the hydrolysis of interfering substances is prevented by precipitation one is able to titrate the alkali hydroxide with standard acid utilizing a common indicator such as phenolphthalein for precise determination of the endpoint as shown in Equation VI

$$\text{VI.}\quad 2KOH + H_2SO_4 \xrightarrow{\text{Phenol-phthalein}} K_2SO_4 + 2H_2O$$

Boric Acid Determination

Another specialized method particularly adapted for the plater which the Project has worked on and has published in Plating includes the determination of boric acid in nickel plating baths[1]. Of the several methods for the determination of boric acid published in the literature, not one has been particularly adapted for the determination of boric acid in the presence of large quantities of nickel as found in plating baths. As a consequence the use of standard methods for the determination of boric acid in nickel plating baths results in considerable error. Accordingly, the work of Project 2 was devoted to adapting the presently available methods for the determination of boric acid to its determination in baths containing large amounts of nickel sulfate and chloride.

The usual method for the determination of free boric acid in boric acid solutions involved the titration of any mineral acid present with standard caustic using bromo-cresol purple indicator, followed by the determination of boric acid as strong acid using caustic soda and phenolphthalein indicator after the addition of mannitol has been made. The steps in this determination are shown in equations VII and VIIIA, VIIIB below:

$$\text{VII.}\quad H_2SO_4 + 2NaOH \xrightarrow[\text{Purple}]{\text{Bromo-cresol}} Na_2SO_4 + 2H_2O$$

$$\text{VIIIA.}\quad H_3BO_3 + C_6H_{14}O_6 \rightarrow C_6H_{12}O_6.BOH + 2H_2O$$

$$\text{VIIIB.}\quad C_6H_{12}O_6.BOH + NaOH \xrightarrow[\text{phthalein}]{\text{Phenol-}} C_6H_{12}O_6.BONa + H_2O$$

A titration curve for boric acid as a strong acid, following the addition of mannitol, is shown in curve 1, Fig. 1 attached. It is to be noted that a sharp break occurs at the equivalence point of this titration and that phenolphthalein can be used as an indicator for precise determination, providing only boric acid be present in the solution.

The presence of nickel ions in the solution in which boric acid is to be determined interferes with the titration for the boric acid, as shown in Curves 2 and 3 of Fig. 1. Curve 2 shows the very much smaller break which developed at the equivalence point during the titration of boric acid with NaOH when moderate amounts of nickel are present and Curve 3 shows only an infinitesimal break at the equivalence point, in the same titration when a large amount of nickel is present. These small breaks in the titration curve for the determination of boric acid in the presence of nickel indicate the large error which normally is obtained when the titration is carried out in this fashion. Equation IX

shows that nickel sulfate may be titrated with the standard sodium hydroxide in the presence of phenolphthalein indicator to yield nickel hydroxide which will interfere with the simultaneous determination of boric acid as a strong acid. Thus the hydrolysis of nickel salts will prevent one from precisely determining the boric acid content of a nickel plating bath

$$\text{IX.}\quad NiSO_4 + 2NaOH \xrightarrow{\text{Phenol-phthalein}} Ni(OH)_2 + Na_2SO_4$$

Boric acid may be precisely determined as a strong acid without interference due to hydrolysis of nickel salts, provided the soluble nickel salts are precipitated with the aid of such precipitating agents as potassium ferrocyanide. The method for the determination of boric acid as recently published by Project 2 adapts the standard boric acid titration for the use in nickel plating baths by means of the precipitation technique described above and as shown in equation X.

$$\text{X.}\quad NiSO_4 + K_4Fe(CN)_6 \rightarrow Ni_2[Fe(CN)_6] \downarrow + K_2SO_4$$

A titration curve for the determination of boric acid in a Watts' nickel plating bath containing the usual impurities is shown in Fig. 2. Here it is noted that nickel hydrolysis is suppressed by virtue of the addition of potassium ferrocyanide and consequent precipitation of nickel ferrocyanide. The sharp break obtained in the determination for boric acid permits the operator to utilize phenolphthalein indicator for the determination of boric acid without the necessity of filtering the solution.

Conclusions

The foregoing brief report is indicative of the type of work which the Project proposes to carry out upon the reactivation of Project 2 at Lehigh University. It is proposed to examine the presently available methods for the determination of macro constituents in chromium, silver, nickel and brass plating baths. New techniques and special application of available methods to plating bath practice will be investigated wherever necessary.

As a result of the preliminary efforts in this direction, AES Vice-President Dr. Ralph Schaefer has appointed a new group, the Publication Committee. It will be the purpose of this new committee to investigate the feasibility of publishing for the Society a handbook entitled "Handbook of Solution Control for Platers". It is expected that as a result of the reactivation of Project 2, research on the macro methods for the determination of chemical constituents in plating solutions will continue under the sponsorship of the AES Research Committee. Upon the completion of this work, it has been proposed that the newly organized Publication Committee select an editor for this research work who will attempt to correlate the material and publish it in handbook form for the entire membership. Cooperation between the AES Research Committee in developing fundamental experimental research and the newly organized publication committee in publishing the results of this work in the form useful to the plater should be a great asset to the members of the AES

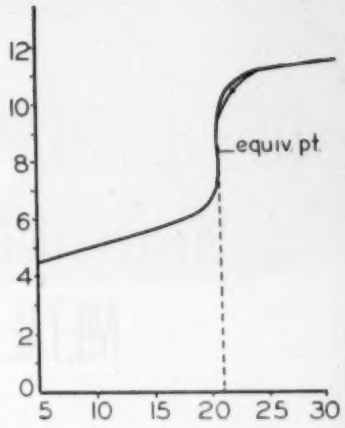

Fig. 2. Smooth curve is boric acid-sodium hydroxide titration curve when nickel is absent. Second curve is indicated by a circle where it does not coincide with the smooth boric acid-sodium hydroxide titration curve. It is the boric acid-sodium hydroxide titration curve when the nickel present is precipitated by potassium ferrocyanide and metal ions are present as impurities

Reference Cited

1 E. J. Serfass, R. B. Freeman, E. Pritchard, Plating 39, 59–62 (1953).

DISCUSSION

Mr. Herbert E. Fennell (Heintz Manufacturing Company, Philadelphia, Pa.): Are there any methods for satisfactorily determining the types of metal-cyanide complexes present in a given brass or "bronze" (90–10) plating solution?

Dr. Serfass: There are no effective methods for determination of free cyanide in brass or bronze plating baths that can be used today with any degree of accuracy. I know of two papers that are being published within the next few months involving specialized methods for the determination of free and total cyanides in brass and bronze baths. I can tell you about those in detail later, but I suspect within the next year we will have at least partially satisfactory methods as a result of Project 2 work in addition to these other papers I have mentioned.

Mr. Fennell: I would like to add a comment while we are discussing brass plating baths. Additions of ammonium sulfate, we discovered, are an excellent method of simultaneously lowering and stabilizing the *p*H of cyanide brass plating solutions. The standard, time-honored method of reducing the *p*H of these baths has been to use sodium bicarbonate. However, it is usually found, when running a Hull Cell determination of desirable current density ranges, that repeated additions of sodium bicarbonate will eventually result in a dull, cloudy deposit at the high and low current density areas (ends of the plate).

We also learned that, where it is necessary to reproduce consistently the slightly "greenish-yellow" tint of 70–30 cartridge brass, the ammonium radical helped impart the desired color. After extensive tests we were unable to find the sulfate radical deleterious in any manner. On the contrary, it seemed to aid in proper anode solution. (Do not utilize ammonium sulfate in bronze plating solutions as they tend to change the deposit to a yellowish brassy color.)

Mr. Frank Passal (United Chromium, Inc., Detroit, Mich.): I would like to make several comments on the method for boric acid determination recently published by AES Research. We have tried the method and found that certain modifications improved the accuracy and convenience. These are the following:

1. Since most nickel plating baths in commercial operation are more alkaline to the indicator than the published procedure indicated, the initial *p*H adjustment is carried out by adding 0.1 N H_2SO_4 until the color changes to apple-green, followed by careful addition of 0.1 N NaOH until the color just changes to a bluish-green.
2. Since the recommended saturated solution of mannitol molds rather badly on standing, it has been found preferable to add the mannitol as a solid using 3 to 5 grams per determination.
3. In analyzing solutions with a high nickel content, such as 45 oz/gal nickel sulfate or higher, the end-point tends to be sluggish and indistinct. It has been found preferable to dilute the sample suitably before the boric acid determination.
4. Instead of using a sodium hydroxide solution of accurately determined

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normality, an approximately 0.1 N solution is used which is standardized against a Watts' nickel bath containing an accurately known concentration of boric acid. The use of standard nickel plating solution obviates the necessity for periodically redetermining the exact normality of sodium hydroxide solution.

In the published article several possible methods for the determination of boric acid were considered. A possible method which was not considered is the use of a cation exchange resin for removal of heavy metals. Such a procedure involving the use of Amberlite IR 120 resin has been used quite successfully in our laboratory for over two years.

DR. SERFASS: Each of those suggestions is very good. We have considered all of them except the ion exchange suggestion and I think I am at liberty to state that there will be a paper published in PLATING by Gunnar Gabrielson from Sweden, using, strangely as it may seem, exactly the same resin you mentioned, IR 120, for removing heavy metal ion.

The procedure suggested by Gabrielson in his article works as well as ours does, except that Gabrielson's method requires more time because it is necessary to run the solution over the ion exchanger prior to the titration. The precision is as good if not better than ours and I suspect you found the same thing by using ion exchange resins.

As to the point you made concerning the addition of a small amount of acid prior to the titration; we did not run into that while we were developing the method, because most of the baths we tested were sufficiently acid at the start. However, if a bath is not sufficiently acid, it might be well to add a known amount of acid first, then proceed with titration as you suggested.

Although our paper did not discuss the high nickel content baths, your point is well taken. If the nickel content is quite high, the end point is a bit sluggish and if you dilute the solution 1-to-1 just as the titration progresses, you improve the endpoint materially.

MR. RAYMOND ABAZIA (Curtis Wright Corporation, Woodridge, N. J.): In industrial silver plating baths, we have had difficulty analyzing for the KOH additions (other than *p*H) we make, when there is a high content of carbonate. Do you know of any satisfactory method?

DR. SERFASS: There are no published methods for the determination of alkali hydroxide in silver plating baths, but I believe you could modify the one I suggested at the end of my paper in which the carbonate is precipitated with barium nitrate and the excess cyanide is precipitated with silver nitrate. The hydroxyl present from the added KOH is then titrated with acid.

project no. 5

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* AUTHORS

EFFECT OF IMPURITIES AND PURIFICATION OF ELECTROPLATING SOLUTIONS

I. NICKEL SOLUTIONS

7. The Effects and Removal of Chromium

ABSTRACT

The effects of hexavalent chromium, Cr (VI), and trivalent chromium, Cr (III), on the appearance, adhesion, ductility, salt-spray (fog) corrosion resistance, hardness and throwing power of nickel deposits were studied. High and low *p*H Watts', nickel-cobalt and organic solutions were used. In general, moderate changes in appearance occurred; adhesion remained unchanged; ductility was lowered more with Cr (VI) than Cr (III); Cr (III) decreased salt-spray corrosion resistance while Cr (VI) had little effect. Electrolysis below 40 amperes per square foot was found unsatisfactory for the removal of either Cr (VI) or Cr (III) due to the anodic reduction of Cr (VI) to Cr (III). However, the concentration of chromium may be reduced to 5 mg/l or less by high *p*H treatment if the Cr (VI) is first reduced to Cr (III). Hexavalent chromium in sufficient quantities will prevent deposition of nickel.

I. Introduction

This paper is the seventh of a series dealing with the effects of impurities in, and the removal of impurities from, plating solutions.

The effects of chromium as an impurity in four types of nickel plating solutions were studied and data are presented which show the accompanying changes in certain physical properties of the electrodeposited nickel. McNaughton and Hammond[1] reported that reduced cathode efficiency and stress in the deposits resulted from the presence of chromic acid in nickel plating solutions. Chromic sulfate also caused a reduction in efficiency together with a slight brightening effect. Hothersall and Hammond[2] reported that the effects of chromic acid in nickel plating solutions were more accentuated at a low *p*H than at a high *p*H. Pietrafesa[3], Puri and Seth[4] and Martin[5] obtained results in agreement with Hammond and his co-workers. For the removal of chro-

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mium, precipitation at a high *p*H after reduction to the trivalent state with iron sulfate was recommended[1]. Addition of calculated amounts of lead salts, especially the carbonate, was reported by Weisberg[6] and by Diggin[7] to be a method for the removal of chromium (VI). Weisner[8] showed that the equilibrium concentration of chromium (III) at a *p*H of 5.4 is 2 mg/l in buffered nickel sulfate solutions. He also showed that high *p*H precipitation is satisfactory only for chromium present in the chromium (III) state.

In this investigation the study of the behavior of chromium was divided into two parts, each of the common valence states (III and VI) being studied separately. The nickel solutions used were described fully in an earlier paper[9]. They consisted of two of the Watts' type, at *p*H 2.2 and *p*H 5.2, which gave grey deposits and two which gave bright deposits: one using organic brighteners, the other being an alloy type containing small amounts of cobalt.

Since it had been reported by Nyquist[10] that nickel metal in a low *p*H nickel sulfate solution would reduce trivalent iron to the divalent state, i. e., the ferrous state is the more stable form, the effect of metallic nickel on the valence state of dissolved chromium was studied. It was found that hexavalent chromium, chromium (VI), was unstable, being reduced to the trivalent chromium (III) form. Experiment also showed that at 40 amp/sq ft the total concentration of chromium in solution decreased noticeably only so long as an appreciable amount, i. e., about 5–10 mg/l of chromium (VI) was present. When the chromium (VI) concentration dropped to 5–10 mg/l detectable removal of chromium practically ceased. During these experiments it was noted that the concentration of chromium (III), in a solution originally containing only chromium (VI) as an impurity, built up during electrolysis more rapidly than the total chromium in solution was reduced. Eventually a state was reached in which all the chromium in solution was in the trivalent state and the concentration of the chromium did not change appreciably with further electrolysis of the solution. To substantiate the electrolytic removal of chromium, analyses were made of strip deposits from solutions containing hexavalent chromium in which a drop of 40–50 mg/l total chromium concentration occurred. Chromium was found in these deposits in trace amounts, though its form was not determined. When solutions containing chromium originally in the trivalent state only were electrolyzed at 40 amp/sq ft, little or no change could be detected in the chromium concentration and at no time could any hexavalent chromium be detected.

Electrolysis at low current densities, i. e., 10 amp/sq ft, of solutions containing hexavalent chromium resulted in the complete reduction of the chromium (VI) to chromium (III) with no noticeable change in total chromium content, indicating higher current densities are required for the deposition of the chromium. Electrolysis of solutions which contained originally trivalent chromium, using low current densities caused no detectable change in the chromium concentration, showing that at low as well as at high current density trivalent chromium is removed very slowly, if at all, by electrolysis.

In this study it was noted that a concentration of 80 mg/l or more of chromium (VI) drastically reduced the efficiency of the deposition. With sufficient hexavalent chromium initially present the deposition of nickel would cease after a very thin, poorly adherent and discolored layer had been deposited. As the electrolysis continued, the chromium (VI) was gradually reduced; eventually, deposition of nickel was resumed, as a nodular deposit. The nodules were widely separated at first, then became more numerous and more closely spaced. When the chromium (VI) concentration had been sufficiently reduced, the deposit became continuous though at first with poor adhesion and a tendency to flake off. Eventually sufficient reduction of chromium (VI) produced conditions under which a uniform, adherent deposit of normal appearance was produced. At this point there still remained amounts of hexavalent chromium varying from 40–60 mg/l in solution.

Since it was found that chromium was stable in the trivalent state in nickel sulfate solutions and that hexavalent chromium could not be present during electrolysis without some trivalent ions being formed, it was decided to study the effect of the presence of dissolved trivalent chromium first. Having thus determined its effects, a study of the hexavalent-trivalent combination of ions would give an insight to the effect of the hexavalent ions. In the latter part of the study the trivalent chromium was kept as low as feasible without spending excessive time on its removal. Generally, the chromium (III) concentration varied from 0–20 mg/l, with a maximum of 35–40 mg/l.

II. Experimental

Preparation of Panels and Evaluation of Physical Properties

The methods for the preparation and purification of solutions, the preparation of deposits and the subsequent testing of the physical properties of the deposits were those described in a previous publication[9]. Two modifications in the procedure for the preparation of deposits were made. The size of the vertical section of the bent cathode was reduced from 2 x 3½ inches to 2 x 3 inches, a change necessitated by the dimensions of the raw material available for the preparation of the panels. The second modification was the elevation of the operating temperature of the alloy-type plating solution from 55° C to 60° C in order to improve the bright plating range.

Since the methods for evaluating the effects of the chromium on the deposits were largely visual and involved the human element, reference panels were prepared from a pure sample of each of the four types of solutions being investigated. These pure deposits served as the basis for the evaluation of the physical properties of the specimens made from solutions containing various known amounts of chromium. Changes in the physical properties of the deposited nickel were reported as per cent changes from the norm shown by the pure standards except in the case of appearance. In judging this property two scales were necessary. For the grey deposits from the Watts' type solutions the Eastman grey scale was used. An arbitrary scale of brightness ranging from "mirror bright" to "dull" was established for the two types of bright deposits.

The concentration ranges for both hexavalent and trivalent chromium used were established individually for each type of solution since the exact effects and limits of chromium were not known. It was found that the four baths had different maxima of concentration at which satisfactory deposits could be obtained. With the nickel-cobalt alloy type solution, more trivalent chromium could have been added, but it was felt sufficient to use the maximum that could be used in any of the other types of solutions. With trivalent chromium the concentrations were 0, 5, 12.5, 50, 75, 125 and 250 mg/l; with the maximum concentrations for the Watts' *p*H 5.2 solution at 50 mg/l; the organic type solution at 125 mg/l; and the Watts' *p*H 2.2 and nickel-cobalt type solutions at 250 mg/l.

The limit for the Watts' *p*H 5.2 solution was low because all of the chromium did not remain in solution even at the lowest concentration, e. g., 5 mg/l and it was felt that the effects were not of dissolved chromium so much as of precipitated chromium. The limits for the Watts' *p*H 2.2 solution and the organic type solution were chosen at 250 mg/l and 125 mg/l trivalent chromium respectively because at these concentrations the baths became difficult to control with respect to the *p*H. The *p*H rose very rapidly with an increase in the concentrations of the impurity in the respective solutions and in conjunction with the rise in *p*H, detrimental effects appeared such as peeling and blackening at the solution line on the vertical section of the panel; also gassing, peeling and blackening of the deposit on the underside of the horizontal section of the panel were noted. To obtain satisfactory deposits at these concentrations of trivalent chromium, the *p*H had to be maintained at or slightly below

the specified values of 2.2 for the Watts' solution and 3.2 for the organic type.

In the study of hexavalent chromium much the same effects were noted at lower concentrations. The exact concentration at which the adverse effects due to hexavalent chromium appeared was greatly influenced by the amounts of trivalent present, therefore attention was directed toward keeping the chromium (III) concentration relatively low, i. e., 40 mg/l or less. Again with the Watts' *p*H 5.2 solution, a precipitate of the chromium (III) formed almost immediately and because of its pronounced effect on the deposit, a low limit of hexavalent chromium was set. It was impossible to exclude the effects of the precipitated chromium (III) in this case. The concentration limits at which usable deposits could be made by keeping the *p*H under close control and maintaining a low chromium (III) concentration were: Watts' *p*H 2.2, 60–75 mg/l; organic type, 20–35 mg/l; nickel-cobalt alloy type, 40 mg/l or slightly more.

TABLE I. EFFECT OF TRIVALENT CHROMIUM ON THE APPEARANCE OF NICKEL DEPOSITS

Trivalent Chromium Concentration mg/l	Bath Type			
	Watts' *p*H 2.2	Watts' *p*H 5.2	Organic *p*H 3.2	Nickel-Cobalt *p*H 3.75
0	1½*	2*	Mirror Bright	Mirror Bright
5	1½	2	Mirror Bright	Mirror Bright
12.5	1½	2	Mirror Bright	Mirror Bright
25	1½	2	Mirror Bright	Mirror Bright
50	1½	2	Mirror Bright	Mirror Bright
75	1½	—	Slightly Milky	Mirror Bright
125	1½	—	Slightly Milky	Mirror Bright
250	1½	—	—	Mirror Bright

*Step of Eastman Grey Scale

Effects on Physical Properties

A—Trivalent Chromium

1. *Appearance.* Table I summarizes the effect of the soluble trivalent chromium in nickel plating solutions on the appearance of the vertical sections of the deposits from these solutions. In general, no effect was noticeable until the concentration of the chromium reached 50 mg/l for the deposits from the Watts' solution (*p*H 2.2) and 75 mg/l for the bright deposits. All deposits from the high *p*H (5.2) Watts' solution containing chromium showed roughness attributed to the presence of precipitated chromium. The deposits from the Watts' *p*H 2.2 solution were finer grained and smoother than the pure deposits when the chromium concentration varied from 50 to 250 mg/l. A concentration of 75 mg/l or more of chromium in the organic type solution caused the deposits to be milky. The only effect noticed in the deposits from the nickel-cobalt alloy type solution was the increase in stress in the deposits evidenced by a bending of the panel in plating when the chromium content varied from 75 to 250 mg/l. At no time during this study did the chromium affect the very low or medium current density areas adversely.

2. *Adhesion.* The adhesion of the nickel deposits to the steel base metal was measured by the bend test, described in an earlier publication[3], in which the horizontal lip of the panel was creased under pressure along the short axis and the fold examined under a 40 power microscope. This test, though qualitative, was the most suitable for this work, approximating satisfactorily, methods used in industry. In this study, at all concentrations used, the chromium in the trivalent state did not discernibly affect the adhesion of any deposit to the base metal as long as proper operating conditions were maintained. At the higher concentrations, 125–250 mg/l, the highest current density regions would show poor adhesion if improper plating conditions were used, i. e., the *p*H of the solution were allowed to rise.

3. *Ductility.* The presence of trivalent chromium as an impurity caused a decrease in the ductility of the deposits from all four types of solutions. The concentration at which the decrease first became noticeable varied for each type of solution. In the Watts' *p*H 2.2 bath the decrease was first noticed with 12.5–25 mg/l chromium present. From 20–250 mg/l the decrease in ductility remained approximately the same. A continuous decrease in ductility with increase in chromium content was shown by the deposits from the high *p*H Watts' solution starting with 5 mg/l chromium. The loss in ductility was greatest for this type of solution. The ductility of the deposits from the organic type solution showed no change until a concentration of 25 mg/l chromium was present. The ductility decreased then with increasing chromium concentration up to 75 mg/l, the maximum concentration at which a strippable foil could be made. A decrease in the ductility of the deposits from the nickel-cobalt alloy type solution was noticed when the chromium content reached 50 mg/l but did not change with further increase in chromium content up to 250 mg/l.

TABLE II. EFFECT OF CHROMIUM (III) ON THE HARDNESS OF NICKEL DEPOSITS

Chromium Concentration mg/l	Bath Type			
	Watts' *p*H 2.2	Watts' *p*H 5.2	Nickel-Cobalt *p*H 3.75	Organic *p*H 3.2
	Per Cent Change			
0	0	0	0	0
5	−11	+15	+ 8	− ½
12.5	−13	+38	+15	−41
25	−16	+58	+ 2	−29
50	−14	+97	− 4	−31
75	−15	—	+ 2	−12
125	−15	—	− 9	− 3
250	−23	—	− 4	—

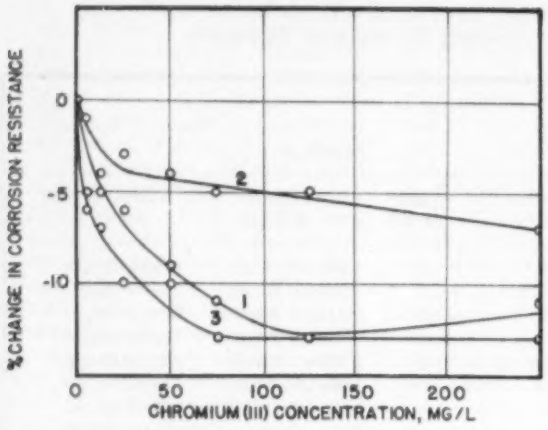


Fig. 1. Effect of chromium (III) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the Watts' pH 2.2 type solution
1. 0.001 in deposit
2. 0.0015 in deposit
3. 0.0003 in deposit

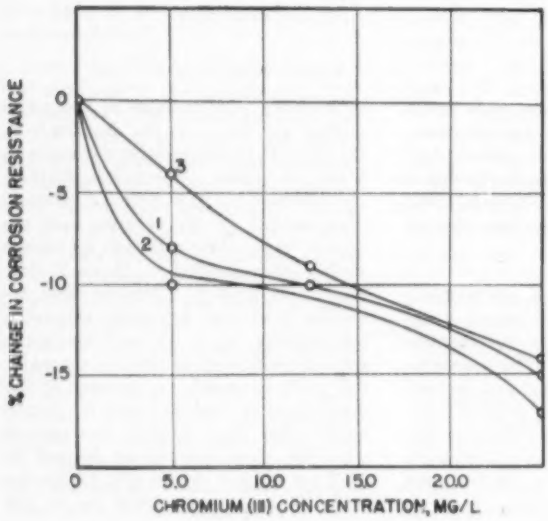


Fig. 2. Effect of chromium (III) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the Watts' pH 5.2 type solution
1. 0.001 in deposit
2. 0.0015 in deposit
3. 0.0003 in deposit

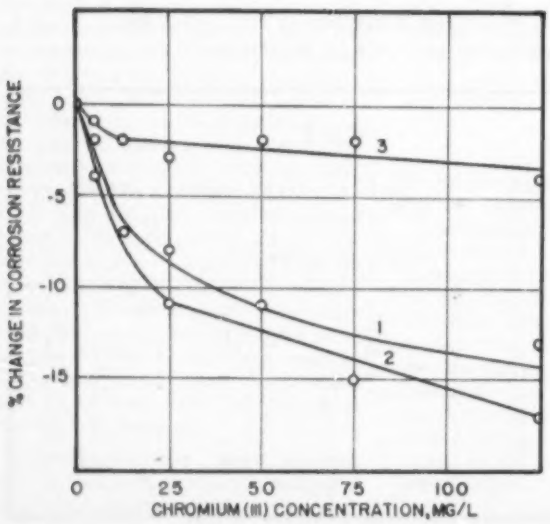


Fig. 3. Effect of chromium (III) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the organic type solution
1. 0.001 in deposit
2. 0.0015 in deposit
3. 0.0003 in deposit

The test for ductility, described in a previous paper[9], consisted of repeatedly creasing with the fingers a predesignated portion of the stripped deposit until the first indications of rupture appeared.

4. *Hardness.* The hardness tests were made at the National Bureau of Standards with a Tukon hardness tester. Insufficient thickness of deposits (0.002 inch) necessitated the change from the Eberbach microhardness tester which was used in previous investigations. In Table II is listed the per cent change in hardness as a function of the Cr (III) concentration for the various types of plating solutions. In general, the Watts' *p*H 2.2 and the organic deposits demonstrated a marked softening with increased Cr (III) contamination, while the Watts' *p*H 5.2 and the nickel-cobalt deposits became harder. Note that the hardening effect increases with increasing *p*H.

5. *Salt Spray (Fog) Corrosion Resistance.* Following the procedure set forth in ASTM Specification B117–49T and the system of rating described in a previous paper[9], the change in corrosion resistance of the deposited nickel due to the presence of chromium in solution was evaluated. The deposits subjected to salt spray were compared to ASTM panels No. 11 (before breakdown), No. 9 (at breakdown), and No. 7 (after breakdown), giving a standardized procedure for the evaluation of this physical property. The test specimens were unbuffed nickel plated steel. Three thicknesses of deposits—0.0003, 0.001 and 0.0015 inch—were made in triplicate at each concentration of chromium used. The deposits were cleaned with magnesium oxide prior to exposure to the corrosion test. The results are reported as per cent change from the breakdown time of the standard deposits made from solutions containing no chromium. The deposits were examined at one-half hour and one hour intervals.

As shown in Figs. 1, 2, 3 and 4, the presence of trivalent chromium in general decreased the corrosion resistance of the deposited nickel from the four types of solutions investigated. The decrease, rapid at first, leveled out as the chromium concentration increased. Within experimental error, the decrease in salt-spray (fog) corrosion resistance was the same for the 0.001 inch and 0.0015 inch deposits. The response of the 0.0003 inch deposits was very similar to that of the heavier deposits except in the case of the organic type solution in which, within experimental error, little if any change was effected by the presence of chromium in solution.

6. *Throwing Power and Efficiency.* Since, with proper *p*H control, no gassing was observed at the cathode during the preparation of test panels in the solutions containing chromium as an impurity, it was assumed that no change occurred in

cathode efficiency and that any change in the deposit thickness was due to a change in the throwing power of the solution. Using the procedure outlined in a previous paper[1], the thickness of the deposits was measured by examining a predesignated area of the cross-section of the deposits with a Bausch and Lomb research metallographic microscope. Table III summarizes the results. In general, no definite trends were shown for either an increase or a decrease in this property. The throwing power tended to increase for all types of solutions investigated except the alloy type. This solution showed in general, a slight decrease over the concentration range of 5–250 mg/l chromium (III). From the results obtained, it may be said that chromium in the trivalent state has no significant effect on the throwing power of the solutions used.

B—Hexavalent Chromium

1. *Appearance.* The effect of hexavalent chromium as an impurity in nickel solutions on the appearance of the vertical sections of the deposits is summarized in Table IV. In general, the concentrations used, with careful control of *p*H and other operating conditions, had little effect on the appearance of the bright deposits. At the higher values, the concentration of trivalent chromium exerted considerable influence, i. e., the higher the chromium (III) concentration, the more critical were the operating conditions and the lower the permissible concentration of hexavalent chromium. In all cases, the chromium (III) concentration was kept below 40 mg/l. In the deposits from all four types of solutions increased stress was evident when the concentration of hexavalent chromium was 15 mg/l or more, if the *p*H and the trivalent chromium concentration were not closely controlled.

In the deposits from the Watts' *p*H 2.2 solution, the most pronounced effect was a whitening of the deposit as the chromium (VI) concentration increased. Roughness from precipitated chromium (III) was present in the deposits from the Watts' *p*H 5.2 solution in addition to the whitening effect. The grain refinement and smoothing effect of trivalent chromium was not apparent in the deposits from the Watts' *p*H 2.2 solution.

2. *Adhesion.* Dissolved hexavalent chromium had no discernible effect on the adhesion of the nickel deposits from the four types of solutions studied within the concentration ranges used as long as certain conditions were met. If the *p*H were allowed to rise too high, i. e., 0.1–0.2 *p*H above the normal operating *p*H of the solution, or if the trivalent chromium concentration exceeded approximately 40 mg/l, the adhesion of the deposit was adversely affected at the air-liquid interface on the vertical section of the panel and the highest current density areas of the

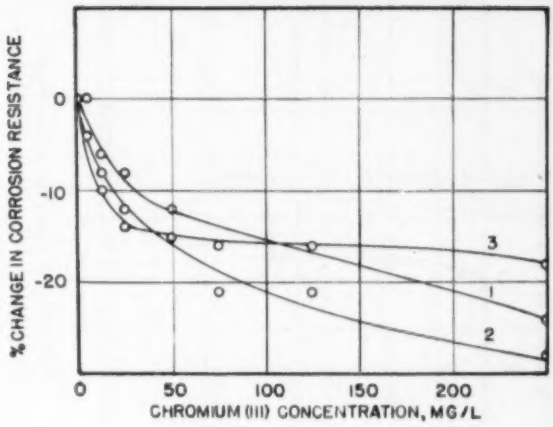


Fig. 4. Effect of chromium (III) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the nickel-cobalt type solution
1. 0.001 in deposit
2. 0.0015 in deposit
3. 0.0003 in deposit

TABLE III. EFFECT OF TRIVALENT CHROMIUM ON THE THROWING POWER OF NICKEL PLATING SOLUTIONS

Trivalent Chromium Concentration mg/l	Bath Type			
	Watts' *p*H 2.2	Watts' *p*H 5.2	Organic *p*H 3.2	Nickel-Cobalt *p*H 3.75
	Per Cent Change			
0	0	0	0	0
5	+10	+2	+10	−5
12.5	+ 3	+2	+ 2	−2
25	+12	+4	+ 3	−8
50	+ 6	+2	+ 4	−8
75	+ 8	—	+ 2	−9
125	+10	—	+ 2	−9
250	+11	—	—	−4

TABLE IV. EFFECT OF HEXAVALENT CHROMIUM ON THE APPEARANCE OF NICKEL DEPOSITS

Hexavalent Chromium Concentration mg/l	Bath Type			
	Watts' *p*H 2.2	Watts' *p*H 5.2	Organic *p*H 3.2	Nickel-Cobalt *p*H 3.75
0	1–2*	1–2*	Mirror Bright	Mirror Bright
5	—	1–2	Mirror Bright	Mirror Bright
10	—	—	Mirror Bright	Mirror Bright
15	1	1	Mirror Bright	—
20	—	—	Mirror Bright	Mirror Bright
35	1	—	—	—
40	—	—	—	Mirror Bright
60	0–1	—	—	—
75	0–1	—	—	—

*Step of Eastman Grey Scale

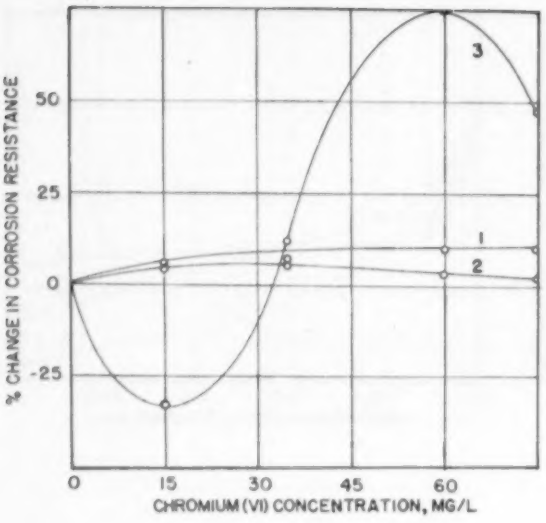


Fig. 5 Effect of chromium (VI) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the Watts' pH 2.2 type solution

1. *0.001 in deposit*
2. *0.0015 in deposit*
3. *0.0003 in deposit*

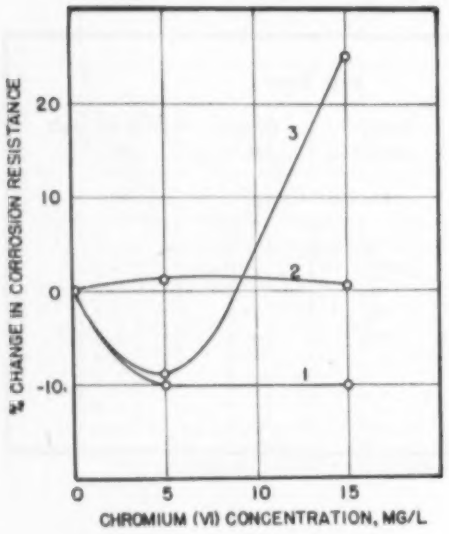


Fig. 6. Effect of chromium (VI) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the Watts' pH 5.2 solution

1. *0.001 in deposit*
2. *0.0015 in deposit*
3. *0.0003 in deposit*

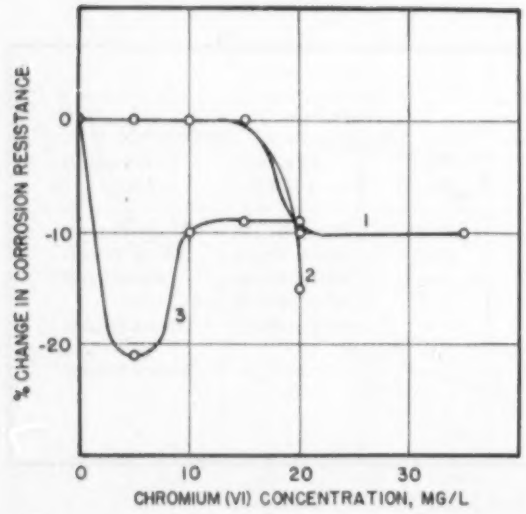


Fig. 7. Effect of chromium (VI) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the organic type solution

1. *0.001 in deposit*
2. *0.0015 in deposit*
3. *0.0003 in deposit*

horizontal section, i. e., the edge nearest the anode.

3. *Ductility.* The presence of hexavalent chromium in solution caused a decrease in ductility of the deposits from the four types of solution. In the Watts' *p*H 2.2 solution, the decrease varied from 9 per cent to 16 per cent in the concentration range of 15–60 mg/l chromium (VI). No ductility measurement could be made for the 75 mg/l concentration level because a satisfactorily strippable deposit could not be obtained. In the Watts' *p*H 5.2 solution, the decrease in ductility was great, ranging from 55 per cent to 85 per cent over the concentration range of 5–15 mg/l. The deposits from the organic type solution showed a decrease varying from 25 per cent to 50 per cent when 15–35 mg/l of hexavalent chromium were present in solution. The decrease in ductility in the deposits from the nickel-cobalt solution varied from a value of 33 per cent with 5 mg/l chromium (VI) present in solution to a value of 60 per cent with 40 mg/l present.

4. *Hardness.* The tests for hardness were made with a Tukon hardness tester at the National Bureau of Standards. Insufficient thickness of the deposits (0.002 inch) necessitated the change from the Eberbach microhardness tester used in previous investigations. The results for the hexavalent chromium series are presented in Table V as per cent change in hardness from that of a pure deposit. In general all deposits except those from the Watts' *p*H 5.2 solution exhibit a decrease in hardness upon addition of chromium (VI). The Watts' *p*H 5.2 deposits increased in hardness up to 43 per cent with but 15 mg/l of chromium (VI). As in the chromium (III) series the ability of the chromium (VI) to harden a deposit increased with an increase in the *p*H of the solution.

5. *Salt-Spray (Fog) Corrosion Resistance.* Because of the rapidity with which the 0.0003 inch deposits broke down and the large per cent change with small time intervals, the discussion of the effect of hexavalent chromium will be based mainly on the results obtained from the tests of the heavier deposits. With thin deposits, a minimum in salt spray resistance of the deposits from all of the baths was noted at the lowest concentrations of chromium (VI) used. The results from the heavier deposits did not show this. Figs. 5, 6, 7 and 8 show the effect of hexavalent chromium on the salt-spray (fog) corrosion resistance of deposits made from the four types of solution containing it as an impurity. In no case was there a significant effect. The gray deposits from the Watts' *p*H 2.2 solution showed increased resistance in both the 0.001 and 0.0015 inch deposits. The deposits from the Watts' *p*H 5.2 solution showed a decrease for the

0.001 inch deposits while the 0.0015 inch deposits showed a slight increase in this property. There was no change in corrosion resistance of the deposits from the organic type solution until the concentration of chromium exceeded 15 mg/l. With a concentration of 20 mg/l, the corrosion resistance decreased 10 per cent. The effect of hexavalent chromium on deposits from the nickel-cobalt type solution was to decrease slightly the corrosion resistance when 10–40 mg/l chromium (VI) was present in solution. These results indicate that the hexavalent chromium tends to counteract the effect of trivalent chromium which decreases the salt-spray corrosion resistance of nickel deposits when present in small amounts.

6. *Throwing Power and Efficiency.* Since no gassing was noted in the concentration ranges studied (as shown in Table VI) as long as plating conditions were controlled, the efficiency was assumed to be unchanged. The test was, therefore, considered a measure of throwing power. The results showed that the presence of hexavalent chromium in solution had an insignificant effect on throwing power. Table VI summarizes the effect of dissolved hexavalent chromium on the throwing power of the four types of solutions studied. The effect of the hexavalent chromium is in general to decrease the throwing power of the nickel-cobalt and Watts' *p*H 2.2 solution and increase the throwing power of the other two. In all cases some trivalent chromium was present in varying amounts sufficient to have a slight effect. The presence of hexavalent chromium modified this effect in all but the organic type solution.

Removal of Chromium

1. *Procedures.* Two methods for the removal of the chromium were studied: electrolysis and precipitation at an elevated *p*H obtained by treatment of the solution with nickel carbonate. The methods of analysis for the hexavalent and trivalent chromium followed those developed by E. J. Serfass, et al[11] under the AES Research Project No. 2, with the following modifications in the analysis for total chromium in solution: the removal of iron was not used since the amount of iron in the original solutions was not detectable and precautions were taken to prevent contamination of the solutions with iron; perchloric acid was not used to destroy the organic material. The latter was done by evaporating the solution sample with a nitric-sulfuric acid mixture to dense fumes. The results obtained using these modifications were deemed satisfactory.

The procedures for the preparation and plating of the deposits and the apparatus for these purification methods were described in a previous publication[9]. Stand-

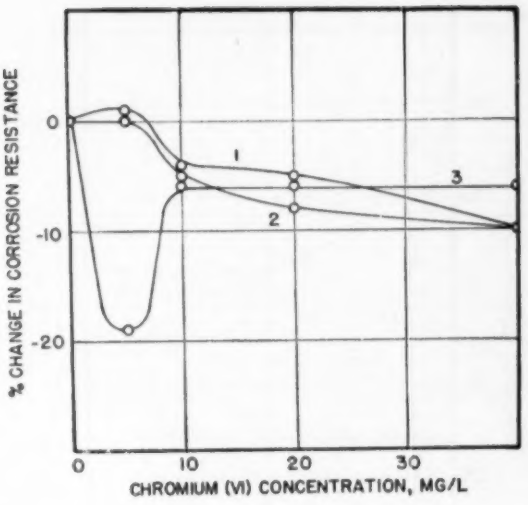


Fig. 8. Effect of chromium (VI) concentration on the salt-spray (fog) corrosion resistance of deposits of varying thicknesses from the nickel-cobalt type solution
1. *0.001 in deposit*
2. *0.0015 in deposit*
3. *0.0003 in deposit*

TABLE V. EFFECT OF CHROMIUM (VI) ON THE HARDNESS OF NICKEL DEPOSITS

Chromium Concentration mg/l	Bath Type			
	Watts' *p*H 2.2	Watts' *p*H 5.2	Nickel-Cobalt *p*H 3.75	Organic *p*H 3.2
	Per Cent Change			
0	0	0	0	0
5	—	—	−14	− 1
8	—	+17	—	—
10	—	—	−15	−18
15	−20	+43	—	+11
20	—	—	+ 5	−15
35	−13	—	—	—
40	—	—	− 4	—
60	−17	—	—	—
75	−21	—	—	—

TABLE VI. EFFECT OF HEXAVALENT CHROMIUM ON THE THROWING POWER OF NICKEL PLATING SOLUTIONS

Hexavalent Chromium Concentration mg/l	Bath Type			
	Watts' *p*H 2.2	Watts' *p*H 5.2	Organic *p*H 3.2	Nickel-Cobalt *p*H 3.75
	Per Cent Change			
0	0	0	0	0
5	—	+5	+3.5	−1.5
10	—	—	+2.0	−4.5
15	0	+7	0	—
20	—	—	+2.5	+0.5
35	−12	—	—	—
40	—	—	—	−1.5
60	− 4	—	—	—
75	−10	—	—	—

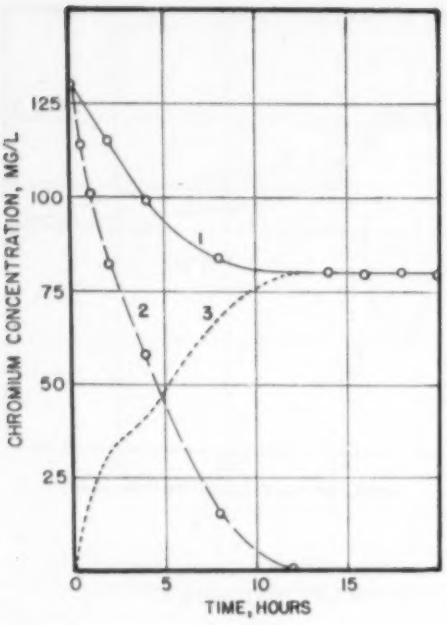


Fig. 9. Effect of high current density (40 amp/sq ft) electrolysis on the concentration of chromium added initially in the hexavalent form
1. Total chromium concentration
2. Chromium (VI) concentration
3. Chromium (III) concentration (by difference)

ard operating conditions of *p*H, temperature, and rate of agitation previously established for each type of solution studied were maintained in the study of the electrolytic removal of chromium. For low current density studies, flat steel cathodes 2 x 3.5 inches were used. These were completely covered with approximately 0.002 inch of electrodeposited nickel since it had been shown in another investigation[12] that at low current densities much below 40 amp/sq ft, the steel cathode was not covered quickly enough to prevent the dissolution of iron and subsequent contamination of the solution. This precaution was unnecessary when current densities of 40 amp/sq ft were used since at this current density the steel cathode was covered rapidly enough to prevent dissolution of the iron in detectable amounts.

In the removal of chromium by precipitation, the procedure was to obtain *p*H values ranging from 2.0–5.5 by adding the necessary amounts of nickel carbonate to the solutions originally at a *p*H of 2.0. Equilibrium conditions were approached by allowing the samples to stand for at least twenty-four hours before the final *p*H measurement was made. Experiment had shown that standing for longer periods had very slight effects on the analytical results. The samples were then filtered and analyzed immediately, before further change could take place. The maximum amounts of chromium used in this procedure were 250 mg/l for the nickel-cobalt alloy type and Watts' type solutions and 125 mg/l for the organic type solution.

2. *Evaluation of Results.* The electrolytic method for the removal of chromium was found to be unsatisfactory at high or low current density. It was found to reduce the hexavalent chromium to the trivalent state, but the concentration of trivalent chromium was not reduced noticeably over extended periods of electrolysis. At 40 amp/sq ft a maximum change of 2 mg/l in the trivalent chromium concentration was detected after six hours of electrolysis. When using a lower current density of 10 amp/sq ft, no change could be detected over more lengthy periods of electrolysis. These results indicated that electrolytic removal of chromium would involve excessive loss of nickel. Figs. 9 and 10 illustrate the inadequacy of the electrolytic method.

The second method investigated for the removal of chromium, that of precipitation at an elevated *p*H obtained by treating the solution with nickel carbonate, proved satisfactory. Fig. 11 shows the effect of *p*H on the trivalent chromium concentration in the four types of solutions. In Fig. 12, the effect of temperature is illustrated. It was found that the chromium concentration could be reduced to a level of 5 mg/l or less with no loss of nickel at a *p*H level which is readily reached, i.e., 5.2–5.5. The higher the temperature at which the precipitation takes place, the more rapid and complete is the removal. To insure as complete a removal as possible, the solution should be held at a high temperature for several hours, and then allowed to stand at room temperature for twelve to twenty-four hours.

The precipitation method is satisfactory only for chromium in the trivalent state. Any hexavalent chromium present in solution is unaffected at *p*H values of 5.8 and higher. To remove the hexavalent chromium economically, it must be reduced and then precipitated. This reduction may be accomplished chemically, e. g., using sulfur dioxide or sulfurous acid in a low *p*H solution, or electrochemically. The first method involves adjusting the *p*H and after the reduction is complete, removal of the excess SO_2 by heating for example. The electrolytic reduction requires more time and means loss of nickel by deposition. A second method of chemical reduction, and perhaps the easiest, is to reduce the chromium with nickel metal. A low *p*H (below 3.0) and agitation are required for efficient results. Considerable time is needed for this method but the least amount of solution treatment and handling is involved.

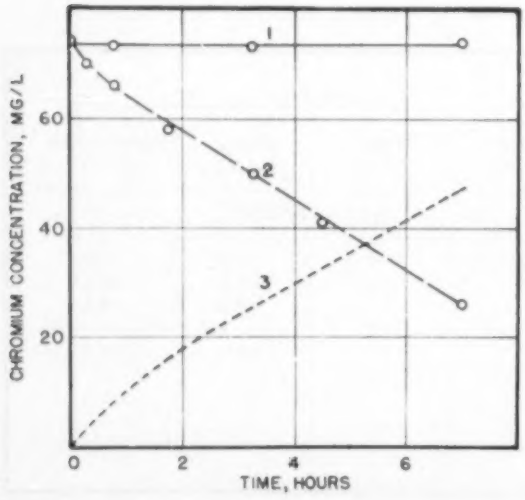


Fig. 10. Effect of low current density (10 amp/sq ft) electrolysis on the concentration of chromium added initially as chromic acid
1. Total chromium concentration
2. Chromium (VI) concentration
3. Chromium (III) concentration (by difference)

Summary

The results of this investigation of the effects of varying concentrations of trivalent and hexavalent chromium or both,

dissolved in nickel solutions may be summarized briefly as follows:

The concentration of trivalent chromium affected the maximum amount of hexavalent chromium that could be present and vice versa: the more trivalent chromium in solution, the lower the concentration of hexavalent chromium must be, the converse also being true. When both were present, their combined effect was greater than when either was present alone.

The effect on appearance of chromium in either the hexavalent or trivalent state was not pronounced. In the Watts' *p*H 2.2 solution the presence of trivalent chromium in excess of 25 mg/l produced a smoother, finer grained deposit. When hexavalent chromium was present in concentrations varying from 15–75 mg/l the deposits were whiter, but not noticeably smoother or finer grained. Trivalent chromium started to precipitate in the Watts' *p*H 5.2 solution almost immediately when trivalent or hexavalent chromium was the initial impurity. Roughness appeared in both cases. The hexavalent chromium produced a whiter deposit than a pure solution, an effect not noticed when trivalent chromium only was present. Chromium in both valence states produced stress in the nickel-cobalt deposits but otherwise had no effect. Its effect on deposits from the organic nickel solution was to cause a slight milkiness when present in the trivalent state in sufficient concentration (125 mg/l or more). Hexavalent chromium had little effect on the deposits from the organic type solution containing up to 20 mg/l.

No discernible change in the adhesion of the deposits to the base metal was noted in the specimens from any of the solutions containing either hexavalent or trivalent chromium within the concentration ranges studied as long as careful control of conditions during deposition was maintained.

The ductility of the deposits from all four types of solutions was noticeably decreased when trivalent or hexavalent chromium was present in solution. The decrease was, in general, more pronounced when hexavalent chromium was the impurity than when trivalent chromium was the sole contaminant.

With the exception of the Watts' *p*H 5.2 deposits, the addition of chromium either in the hexavalent or the trivalent form resulted in a lowering of the hardness. The nickel-cobalt series with chromium (III) showed both an increase and a decrease in hardness. Ability of the chromium to increase hardness seems to be a function of *p*H of the solution.

In general, the salt-spray corrosion resistance of the deposits from the four types of solution decreased as the trivalent chromium content increased. The maximum decrease was of the order of 25 per cent. Hexavalent chromium seemed to have little effect on this property. Its effect was to increase corrosion resistance in some cases, i. e., Watts' *p*H 2.2 and decrease it slightly in others, i. e., organic and nickel-cobalt. The deposits from the Watts' *p*H 5.2 solution showed both an increase and decrease in this property. The hexavalent chromium appeared to override the effect of trivalent chromium to reduce corrosion resistance. The concentration of trivalent chromium had an effect here also. The higher the concentration of trivalent chromium in the presence of hexavalent, the lower was the salt-spray resistance.

The efficiency of the solutions was unimpaired by the presence of trivalent and hexavalent chromium or both. The effect of trivalent chromium was to increase slightly the throwing power of the two Watts' type solutions and the organic type solution. A slight decrease in this property was noted with the nickel-cobalt type solution. Hexavalent chromium increased the throwing power of the organic and Watts' *p*H 5.2 solution and decreased the throwing power of the nickel-cobalt and Watts' *p*H 2.2 solutions.

The concentration of chromium may be reduced to 5 mg/l or less by high *p*H precipitation using nickel carbonate. Maintaining the solution at a temperature of 75° C or higher appreciably increases the rate of removal. Allowing the solution to stand at room temperature for several hours after heating makes the removal more complete. This method is satisfactory for hexavalent chromium if the chromium (VI) is reduced to the trivalent state first by electrolytic or chemical means. For the latter, nickel metal in a solution of low *p*H with agitation works well.

Electrolytic removal of chromium at current densities below 40 amp/sq ft, either from the hexavalent state or the trivalent state, is unsatisfactory. The trivalent chromium is removed very slowly if at all and the hexavalent chromium, although it is deposited at high current densities, is reduced to trivalent faster than it is removed.

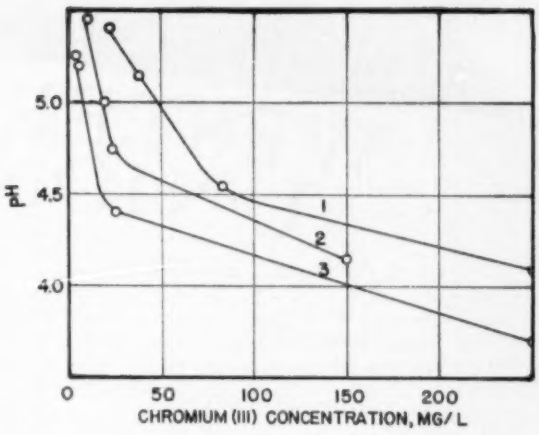


Fig. 11. Removal of chromium (III) from nickel plating solutions by high-pH precipitation (pH 5.5)
1. Nickel-cobalt type solution
2. Organic type solution
3. Watts' type solution

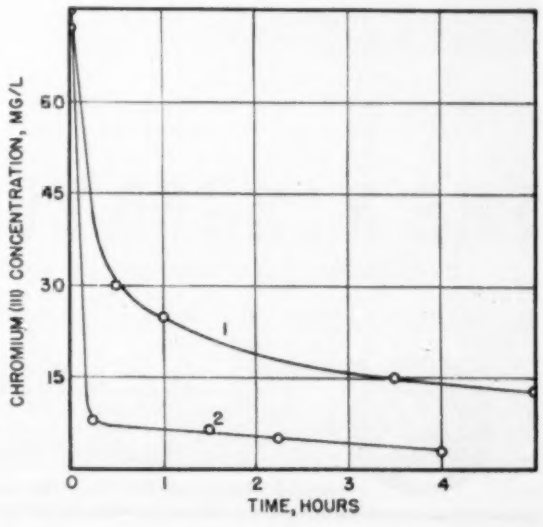
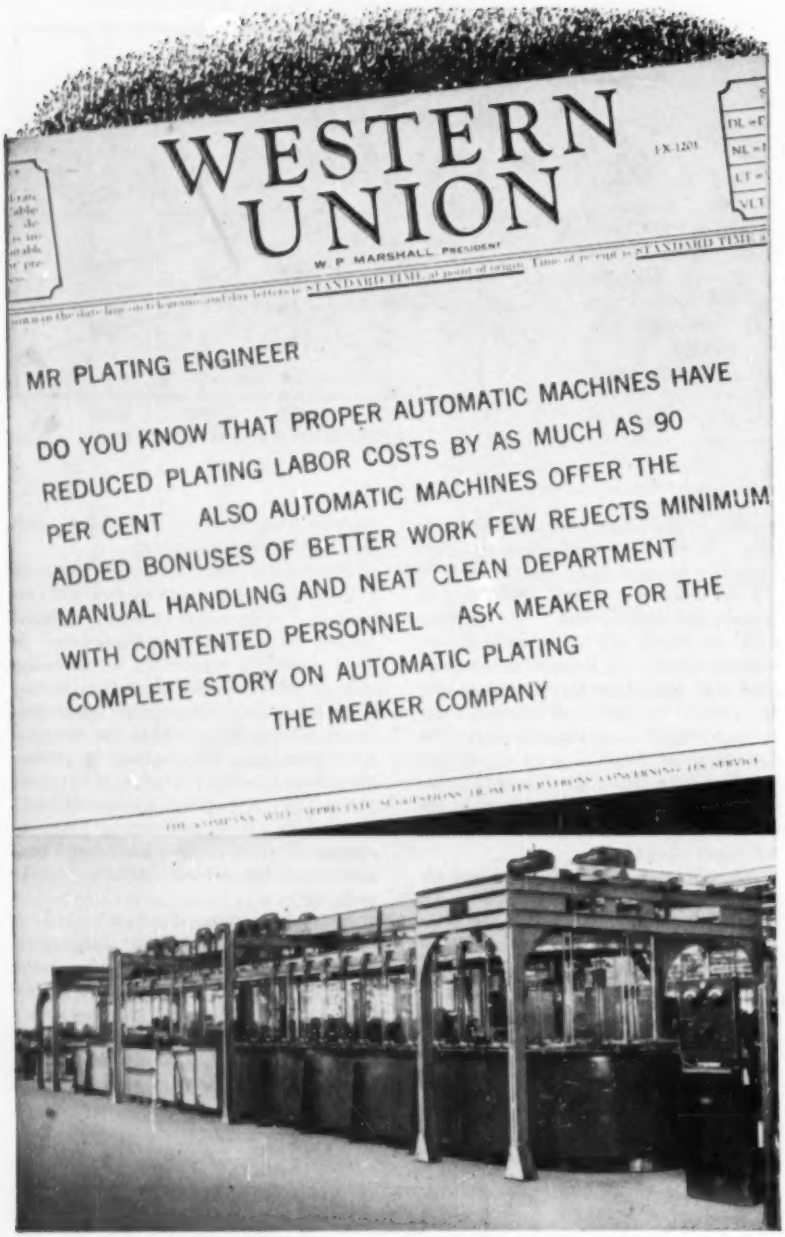


Fig. 12. Effect of temperature and time on the completeness of the removal of chromium (III) by high-pH treatment (pH 5.5)
1. 55° C
2. 75° C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DISCUSSION*

DR. A. M. MAX (RCA Victor Division, Indianapolis, Ind.): Since no mention was made of any measurements on stress, I would like to ask whether such measurements were made and if some information on the effect of the chromium contamination on the stress of nickel deposits was obtained. You mentioned some unsuccessful attempts were obtained in ductility evaluation because of unsuccessful strippable deposits. Were those unsuccessful deposits due to the fact that you could not obtain a coherent deposit which is characteristic of high internal stresses.

PROFESSOR EWING: I don't think we made any measurements on stress as such and it is not included in one of the properties. I think the remark I made was mostly general observation, which was made simply by bending and breaking. No special test was made—I mean we did not evaluate that part of it.

DR. MAX: Were the unsuccessful attempts of the strippable deposits due to the fact that the deposits were not coherent, consequently you could not get large enough specimens for bending, or were they due to something else?

In some of our work we have found that metallic impurities do materially affect these internal stress deposits and since it affects our operation very seriously, we have controlled them very closely.

PROFESSOR EWING: The only thing we did that would bear on that property is the test which we made by bending and by breaking. When we added hexavalent chromium as an impurity, adherence was not very good and that was associated with brittleness, too. These changes, however, in the nickel properties are very, very small.

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* From the record—after the verbal presentation at Philadelphia.

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41st Annual A. E. S. Convention

JULY 12-15, 1954

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George Herrmann *A. Amatore*
Hotel—Banquet Committee Co-Chairmen

When the Headquarters site for the 41st Annual Convention was considered, a committee composed of Franklyn J. MacStoker, AES past president, Alexander N. Braun, president of the NAMF, and George Schore, general chairman of the 1954 Convention, and their wives, who are members of the Ladies' Committee, sought to find a hotel which could house the entire convention and have the necessary banquet, meeting room, exhibit space and suite facilities for the comfort of the conventioneers. Having all the above in mind, the committee, after visiting all of the larger hotels in the city, decided on the Statler Hotel, which is centrally located on Seventh Avenue between 32nd and 33rd Streets. It has 2,200 guest rooms, each with bath, and the hotel has agreed to give the Society enough rooms to house the entire convention.

The large department stores, such as Macy's, Gimbel's, Sak's-34th Street, B. Altman's, McCreery's and Oppenheim Collins, are within walking distance of the hotel, and others can be reached easily. For other forms of entertainment, the Times Square District, which houses the theater, movie, television and night club facilities, is but a few short minutes from the hotel. This entertainment will be made more directly available to the members by Moe Ranno's Visitor Entertainment Committee, a report on which will be covered in detail in a later issue of this journal.

All the large banquet and meeting rooms of the hotel have been placed at the disposal of the housing committee, headed by Co-Chairmen Angelo Amatore and George Herrmann, to assure the membership of adequate meeting and banquet space. The Convention's closing banquet will be held in the Grand Ballroom, which has a seating capacity for 1,600 people and is equipped with the most modern sound, lighting and stage facilities.

The Cafe Rouge at the hotel features many of the outstanding entertainers of the country and boasts a dinner comparable to the best anywhere. For a quick breakfast, luncheon or dinner, there is the Cafe Manhattan, an air-conditioned dining room. The Penn Bar and Cocktail Lounge is one of the most relaxing sites of the hotel. Also air-conditioned and featuring counter and table service is the Coffee Shop, an economical eating place. There are also many other large and well-known eating places in the area, such as Major's Cabin Grill, Rigg's, The Campus, Shein's, and numerous other bars and restaurants.

For the supply groups there are enough suites and parlors to house everyone under the one roof. The Housing Committee will contact the membership in the near future, and it is hoped that requests for rooms will be made as soon as possible.

The Lobby to the Grand Ballroom has been set aside for registration. This large and spacious area will be equipped to give the members fast and efficient service in registering. In order to facilitate registration, the committee, headed by Albert Fusco and Martin F. Maher, Jr., has set up a program of preregistration for those wishing to attend the convention. This service will be available to the members without fear of loss of funds, since those who do preregister but do not attend will have their money refunded. The entire program and the committee and its functions will be covered more fully in later issues.

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Book Review

DR. HAROLD J. READ

Professor of Metallurgy, Pennsylvania State College

MANUAL ON INDUSTRIAL WATER, prepared by Committee D-19 of the A.S.T.M., v + 336 pages, 1953. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. Price, $4.25.

This book is the result of the combined efforts of A.S.T.M. Committee D-19, its associates and other members of the society, and it is intended to serve as a reference source of information for three types of users: executives and plant designers; individuals engaged in industrial operations involving the use of water; and analysts, operators of special instruments, engineers and consultants. The text is not sufficiently detailed to replace an adequate library on the subject for most of these potential users, but it does provide a background of basic information and, through numerous references, it serves as an excellent guide to the more detailed literature for specific and detailed studies of the subject.

The book is divided into two main portions, the first 126 pages being a collection of eight chapters on various aspects of the nature, uses, treatment and testing of industrial water and water-formed deposits. The remainder of the book comprises a collection of the A.S.T.M. standard methods for sampling, analysis, reporting and testing water which have been developed cooperatively by A.S.T.M. Committee D-19.

The first eight pages will be of most interest to executives, plant managers, designers and similar technologists and administrators who are seeking general information on the influence of water in industries where it is used either as a raw material or in conjunction with manufacturing processes. This part of the book might well serve adequately without additional reference when used as a guide to the nature of water planning required at the supervisory and administrative levels of industrial organization.

The second portion of the book is a reprint of all of the pertinent A.S.T.M. standard methods for water technology. It includes an extensive glossary and a table of water requirements for a number of typical industrial operations. Finally, there is a list of A.S.T.M. symposia and technical papers on industrial water dating from 1934 to 1952.

The manual on water is no exception to the usual high quality of A.S.T.M. publications. It is very clearly written, with little or nothing that appears to be either inaccurate or misleading. The book is nicely printed in an easy-to-read two-column format.

The one criticism which might be offered is that there is no index, either author or subject. One hopes that this situation will be remedied in subsequent editions.

Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

The Protective Action of Pigments on Steel*. M. J. Pryor.

The action of aqueous extracts from litharge, metallic lead, red lead, basic lead carbonate, zinc, and zinc oxide on the corrosion of steel was investigated. It was found that litharge extracts inhibited the corrosion of steel completely, that the extracts from metallic lead and red lead inhibited for a short period, and that the extracts from basic lead carbonate, zinc, and zinc oxide lead had no protective action. The protective properties of the decanted extracts were in the same order as their reserve alkalinities. The litharge, metallic lead, and red lead extracts protected only when they contained dissolved air; when deaerated they attacked steel slowly. The passivity film formed in litharge extracts was found to be largely composed of $\gamma - Fe_2O_3$, no lead compounds being detected. It

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

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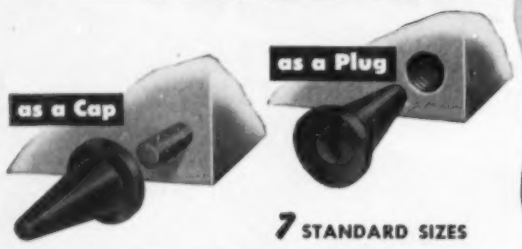

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was considered that the lead in the litharge extracts was present partly in the ionic form, possibly as $Pb(OH)^+$ ions, whereas the lead in extracts from metallic lead was present mainly as massive and colloidal lead hydroxide.

Mechanism of Reaction of Aluminum and Aluminum Alloys with Carbon Tetrachloride*. Milton Stern and Herbert H. Uhlig.

The reaction of aluminum and its alloys in boiling carbon tetrachloride is explained by a free radical chain mechanism. The effects of oxygen, water, hydrogen chloride, corrosion products, inhibitors, magnesium alloy additions, and behavior of aluminum in CCl_4 vapor are discussed.

Aluminum containing manganese or magnesium reaches a limiting weight loss which is a function of the solution volume to specimen area ratio. This behavior is caused by the formation of a protective corrosion product layer formed by reaction of the metal with a critical minimum concentration of soluble corrosion products.

Tests of the Protective Value of Metallic Coatings Under Sheltered Conditions (Marine Atmosphere). S. G. Clark and J. Bradshaw. J. Applied Chem., **3**, 147 (1953).

Results of tests on the corrosion of a range of coatings on steel (electroplated Zn, Cd, Sn, Pb, Pb-Sn and sprayed aluminum and of silver coatings on aluminum) are presented. Most previous studies were made under conditions in which the samples were freely exposed to the weather. This study was carried out in ventilated boxes to determine the protective behavior of the deposits under storage conditions or as components of equipment. Considerable data are given and some of the conclusions are:

Zinc and cadmium coatings on steel with moderate thickness (about 0.5 mil) are likely to give good protection against rusting for a long period. Zinc is superior to cadmium, but chromate passivation of coat-

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

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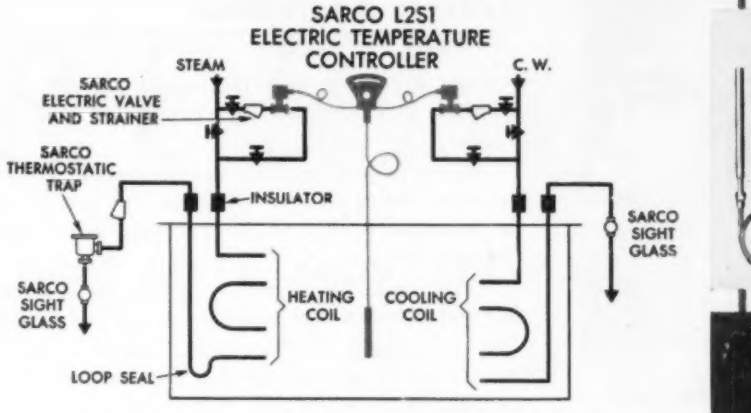

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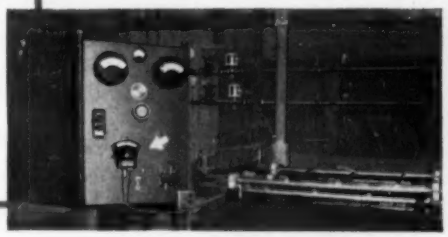

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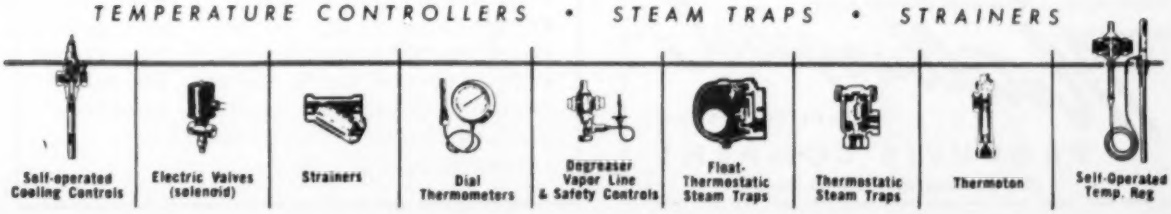

Edmont Case No. 347: Plating small pieces (bolts, nuts, fixtures, wrenches) unlined rubber gloves lasted 5 shifts, job-fitted coated gloves 13 shifts.

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Article Abstracts

ings has a positive protective effect, particularly on cadmium which reverses the position of these two metals.

Coatings of lead, lead-tin and tin corrode at about the same rate as zinc and cadmium, but greater coating thickness is required because the former permit rusting at the pores.

Tin-zinc can be classed as intermediate between zinc and cadmium and lead, tin and tin-lead coatings.

Silver coatings, which are highly corrosion resistant, are satisfactory on steel and aluminum only where substantially pore-free.—D. G. FOULKE.

Electrodeposition of Cellulose*. Charles L. Mantell and Frank Cozzarelli.

Cellulose has been plated at the anode from solutions containing approximately one per cent of cellulose, where the solvent is an alkaline sodium zincate modified by addition of urea.

Potentials of Iron, 18-8, and Titanium in Passivating Solutions*. Herbert H. Uhlig and Arthur Geary.

Potential measurements of iron in chromate solutions indicate adsorption of chromates in accord with the Langmuir adsorption isotherm. $C/\Delta E$ vs C is linear, where C is concentration of chromate and ΔE is corresponding change of potential. Similar linear relations have been found for organic inhibitors which function by adsorbing. Data are presented for 18-8 and titanium in sulfuric acid containing cupric and ferric ions, and in sodium hydroxide, and also for 18-8 as a function of oxygen partial pressure. The data point strongly toward a mechanism of passivity for each of the metals studied, based on adsorption of the passivator. Pitting tendencies of 18-8 and titanium are discussed in relation to their potential behavior.

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

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like the present" to improve your knowledge of modern electroplating techniques. You can gain this knowledge easily and pleasantly through my unique home study course. Once gained you'll profit continuously from it. Write for the facts today. No obligation. Joseph B. Kushner, Electroplating School, 115 Broad St., Stroudsburg 21P, Pa.

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Project No. 2 **Analytical Procedures for Determining Ingredients of Wastes from Plating Plants. Lehigh University.**

Project No. 5 **The Effect of Impurities and Purification of Electroplating Solutions. Michigan State College.**

Project No. 10 **The Disposal of Plating Room Wastes. Yale University.**

Project No. 12 **The Cleaning and Preparation of Metals for Electroplating. Columbia University.**

Project No. 13 **Correlation of the Weathering Behavior of Electrodeposited Coatings with their Permeability to Gases. National Bureau of Standards.**

Project No. 14 **The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating. Ontario Research Foundation.**

Project No. 15 **Accelerated Corrosion Tests for the Performance of Plated Coatings. Firms of Michigan Committee Members.**

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Patent Abstracts

GEORGE B. HOGBBOOM
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No. 2,648,025, August 11, 1953—Method of Electrocoating Strip—J. S. Buser (deceased) by Doris E. Morgan (formerly Doris E. Buser), assignor to National Steel Corporation.

CLAIM 1. The method of continuously and progressively manufacturing electro-tin plated strip comprising the steps of passing the strip through an electrolytic cell containing an acid plating bath of aqueous electrolyte solution including tin salt and fluorine ions, a source of fluorine ions being tin-free acidic fluorine compound present as a component of the electrolyte solution, electrodepositing a layer of tin on the strip while the strip is in contact with the electrolyte solution, thereafter passing the strip from the plating bath with tin-salt containing electrolyte solution carried from the plating bath on the strip, rinsing the strip with an aqueous rinse solution obtained by admixing water and a tin-free acidic fluorine compound in the rinse solution being sufficient to reduce the *p*H value of the aqueous rinse solution to the point where hydrolysis of the tin salt carried from the plating bath on the strip is substantially prevented, thereby removing tin salt from the strip, collecting the rinse solution containing the tin-free acidic fluorine compound and the tin-salt containing electrolyte solution removed from the strip, and supplying the collected rinse solution to the plating system.

9 claims.

References cited: U. S. Patents 2,330,609; 2,372,599; 2,407,579. British Patent 546,269.

No. 2,649,410, August 18, 1953—Electrodeposition of Selenium—Mortimer C. Bloom and Joshua P. Levy,

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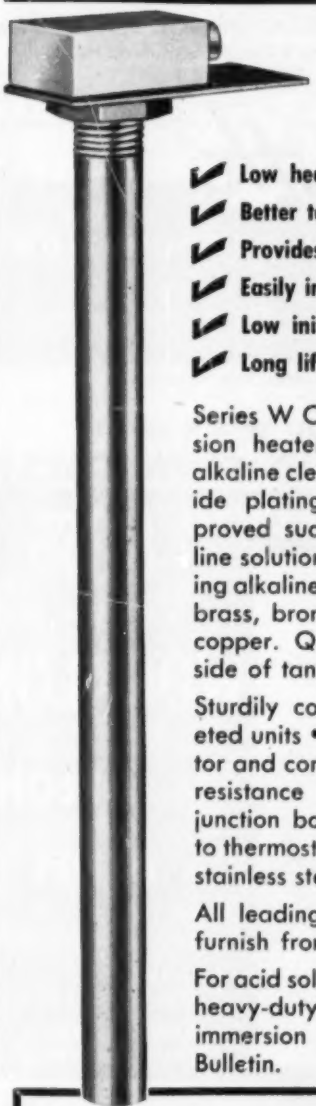

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Patent Abstracts

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In connection with the manufacture of selenium rectifiers it is now known that selenium rectifier elements having excellent physical and electrical properties can be manufactured by the direct electrodeposition of gray crystalline metallic selenium upon an electrically conductive base element which is used as a cathode during electrolysis of a suitable electrolyte, such as a solution of selenium dioxide.

Another object of the invention resides in procedure of the character specified which is adaptable to continuous operation so that the electrolyte may be constantly maintained in a condition which yields the required character of electrodeposit even though extraneous materials such as organic contaminants become introduced during the electrolytic operation.

CLAIM 7. A process for treating an acidic aqueous selenium dioxide electrolytic bath to render innocuous organic impurities therein, which comprises adding thereto a quantity of elemental selenium in the form of particles in a quantity greater than the normal metallic selenium content of said solution, but less than the quantity which presents mechanical interference to electrolysis, and which particles present a substantial total surface to contact with said bath and maintaining the bath at approximately 100° C and in contact with said particles for a period from twelve hours to six days until the effect of the impurities ceases.

7 claims, 7 examples.

References cited: U. S. Patents, 1,103,017; 2,248,092; 2,322,348; 2,414,438; 2,568,780. Alexander, Colloid Chemistry, Vol. 1 (1926), pp. 660–661. Mellor, Comprehensive Treatise on Inorganic and Theoretical Chemistry, Vol. X (1930), pp. 702–703, 763, 850. Sella, Chemical Abstracts, Vol. 34 (1940), p. 2713.

No. 2,650,192, August 25, 1953—Electrowinning Chromium—M. C. Carosella and John D. Mettler, assignors to Union Carbide and Carbon Corporation.

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Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11" x 14" x 12"	30 lb
LSI-10	100 gal/hr	12" x 16" x 16"	40 lb
ASI-300	300 gal/hr	2' x 2' x 2'	125 lb
ASI-400	400 gal/hr	2' x 2' x 2'	135 lb
ASI-600	600 gal/hr	2' x 2' x 2'	150 lb

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Patent Abstracts

metallic chromium utilizing a compartment cell and an electrolyte prepared from an iron-chromium alloy, wherein said iron-chromium alloy is leached with sulfuric acid, successively crystallized to remove iron impurities and produce chromium ammonium alum crystals and a chromium ammonium alum mother liquor, said crystals being dissolved to form the electrolyte, and said mother liquor being recycled to the leaching step, the improvement which comprises recycling the major portion of said chromium ammonium alum mother liquor to said leaching step; adding a minor portion of said chromium ammonium alum mother liquor, under substantially non-oxidizing conditions, to an aqueous solution containing a base selected from the group consisting of alkalies and alkaline earth metal bases at a temperature above 60° C, until a final *p*H below approximately 3.8 is obtained to form a basic chromium sulfate precipitate; separating said precipitate from the solution containing the metallic impurities; and adding said precipitate to the leaching step.

3 claims, 1 flow diagram.

References cited: Lloyd et al: Journal of the Electrochemical Society, Vol. 97 (July, 1950), pp. 227–234.

No. 2,650,900, September 1, 1953—Method of Producing Metal Mesh Screens—H. E. Hohnan, assignor to Electric & Musical Industries, Limited, Hayes, Middlesex, England.

CLAIM 7. The method of producing a metal mesh screen with the aid of a sheet of methyl acrylate, said method including the steps of heating said sheet to about 70° C to soften it, pressing a mesh-shaped impression into the surface of the heated sheet to develop internal stresses in the sheet tending to efface the impression, depositing evaporated metal to form an electrically conductive film on the impressed surface of said sheet and removing said film from areas on said surface enclosed by the mesh formations in the impression, electrodepositing further metal on the conductive film in said impression to form the mesh, and

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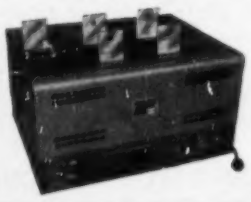

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thereafter heating the sheet to about 110° C to release the stored energy for effacing the impression and displacing the mesh from the sheet.

9 claims, 5 figures.

References cited: U. S. Patents 313,805; 667,600; 1,752,371; 2,055,963; 2,115,855; 2,125,776; 2,151,457; 2,166,367; 2,234,944; 2,252,504; 2,368,085; 2,400,518; 2,422,325; 2,529,086; 2,548,765. British Patent 388,444.

No. 2,650,901, September 1, 1953—Electroplating on Aluminum—Kuno L. van der Horst, assignor to Van der Horst Corporation, Olean, N. Y.

CLAIM 1. The method of preparing an aluminum article for electroplating which comprises vapor blasting that portion of the article that is to be plated, with a mixture of air, water and abrasive particles and thereby breaking down the adherent film of oxide thereon to expose a new surface, the abrasive particles being from one hundred mesh to about twelve hundred and fifty mesh, and subjecting said portion of the article to the action of caustic alkali and alkali zincate to produce a deposit of zinc on said portion of the article.

CLAIM 6. The subject matter of claim 1, characterized by the fact that in addition to subjecting the area to be plated to blasting and to alkali and zincate, said portion of the article, subsequent to blasting is subjected to the action of at least one solution of at least one strong mineral acid and the last significant step in preparation for electroplating consists in subjecting said portion of the article to the action of an aqueous solution of caustic alkali and alkali zincate.

Note in the legend: "Such blasting effect can be obtained for example by using the grit of siliceous rock of Arkansas known as Novaculite".

The acid treatment depends upon the alloy to be plated. In the legend the acid, and mixture of acids used is given in detail.

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kali and zincate treatment, but the action of such an acid solution is not so satisfactory with some alloys as with others. For example, where the alloy contains both magnesium and silicon, usually at least it is either necessary or desirable to treat the article with both sulfuric and nitric acid. To this end the article can be treated first with a solution of sulfuric acid and then with a solution of nitric acid, as indicated above, or in the alternative, the article can be treated with a solution containing both sulfuric and nitric acids.

7 claims.

References cited: U. S. Patents 1,627,900; 1,923,790; 1,984,624; 1,988,645; 2,142,564; 2,414,923. Monthly Review A. E. S. March, 1946, pp. 269, 270, 273, 274, 277. Metal Finishing February, 1949, pp. 48–53.

No. 2,650,902, September 1, 1953—Electrodeposition on Magnesium and Magnesium Base Alloys—William F. Higgins, assignor to Magnesium-Elektron-Limited, Clifton Junction, England.

CLAIM 1. A process for the treatment of magnesium and magnesium base alloys which consists in immersing the magnesium containing article in a first solution of a compound selected from the group consisting of salts of zinc, cadmium and manganese which are soluble in water and are decomposed by the magnesium to produce a metallic coating of one of these metals on the article, contacting the coated article with an aqueous chromic acid solution which leaves the surface of the metallic coating in a passive condition and then contacting the coated article with a solution of at least one of the salts of the group consisting of cyanide of mercury and a nitrate of mercury which leaves the surface of the metallic coating in a condition suitable for electroplating, and, thereafter electroplating the coated article.

CLAIM 2. A process as claimed in claim 1 wherein said first solution is 5–10 per cent solution of the salt and free from chromic acid ions and free from any acids and alkalis and wherein the temperature of said first solution is 20 to 30° C.

CLAIM 3. A process as claimed in claim 1 wherein the chromic acid solution is boiling.

CLAIM 4. A process as claimed in claim 1 wherein

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the metal is immersed in the first salt solution, it is then washed with water and contacted with the chromic acid solution, and these three steps then repeated at least once before the electroplating step.

Legend—metallic solutions used:

1. . . . a 10 per cent solution of $MnSO_4 \cdot 4H_2O$ for 10 seconds.
2. . . . a 10 per cent solution of $CdSO_4$ for 10 seconds.
3. . . . a 10 per cent solution of zinc chloride for a few seconds.
4. . . . using a zinc sulfate solution of 5 per cent or 10 per cent..

5 claims, 6 methods

References cited: U. S. Patents 1,627,900; 1,827,142; 2,233,410; 2,526,544. British Patents 506,466; 507,342. Metal Finishing Vol. 43 (1945), pp. 48–49.

No. 2,650,904, September 1, 1953—Oscillating Rail for Work-Immersion Machines—John V. Davis, Charles W. Chill and Leon J. Pianowski, assignors to The Udylite Corporation.

CLAIM 2. A rail for work-conveying machine comprising a fixed section and an axially aligned sliding section, the meeting ends of said sections having vertical lengthwise slots forming vertical fingers of each section being slidably received in the slots of the other section, thereby forming lengthwise sliding joints, means for oscillating the slidable section longitudinally, the uppermost surfaces of said sections being of like contour and continuous with each other throughout the length of said sections and at their joints, whereby a member suspended from either section may be slid smoothly to the other section without vertical or lateral displacement, and a section mounted for vertical movement and separably joined to and aligned with one of said fixed section of the end thereof opposite the end to which said slidable section is joined.

2 claims, 14 figures.

References cited: U. S. Patents 273,735; 887,539; 977,020; 1,145,338; 1,917,009; 2,274,422; 2,280,728; 2,248,941; 2,439,176; 2,479,322; 2,497,768. British Patent 12,146.

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A.E.S. News

Society Publication File

It is desirable to bind Society Publications so that a permanent A.E.S. record may be maintained at Headquarters. To complete such a project it is found necessary to call on the generosity of the membership for missing issues of PROCEEDINGS, MONTHLY REVIEW, QUARTERLY REVIEW and PLATING.

PROCEEDINGS missing at present are for the years, 1944, 1939, 1938, 1937, 1934 and all prior to 1928.

Missing copies of the REVIEWS and PLATING are:

1910—Jan., Feb., March, April, May, Sept., Oct., Nov.
1911—June, July, Aug., Sept., Oct., Nov., Dec.
1912—Jan., Feb., Sept., Oct., Nov.
1913—March, April, May
1914—March, April, May, Aug., Sept., Oct.
1915—Jan., Feb., March, April, June, July, Aug., Sept., Oct., Dec.
1916—Jan., March, April, May, June, Aug., Oct., Nov.
1917—Jan. through Dec.
1918—Feb., March, May, Sept.
1919—Feb., March, May
1920—Jan., Feb., March, April, July, Aug., Sept.
1921—March, April, May, July, Aug., Nov.
1922—Jan., Feb., March, May, June
1923—Aug.
1926—July
1927—May, June
1928—Oct.
1929—May
1948—Jan., March
1950—Jan.

Two copies each of the missing REVIEWS and PLATING are desired to complete the Headquarter's library. If your copies are filed in an out-of-the-way corner, put them to a more valuable use—send them to Newark.

Editorial Board Plans Convention Program

The Editorial Board met at New Milford, Conn., on October 16. The meeting was held primarily to plan for the Educational Sessions to be held in conjunction with the 41st Annual Convention at New York City. The host branch, New York, was represented by Board Member Milton Nadel and Convention General Chairman George Schore. Gene Combs of Cleveland (1955 host branch) also attended.

Several papers were discussed, and manuscripts of those already in the hands of the Board were assigned for review purposes. Additional papers for the New York Convention continue to be accepted. All authors wishing to present papers should signify their intention by notifying any member of the Editorial Board or Headquarters, or the New York Convention Committee. Abstracts of papers should be supplied no later than January 15, 1954 and the manuscript no later than April 15, 1954.

Elected at the meeting, as advisory members to the Editorial Board and representing the Organic and Polishing and Buffing fields were Dr. G. Klinkenstein of Maas & Waldstein, Newark, N. J., and H. MacAleer, Formax Manufacturing Corp., Detroit, Mich. These advisory members will serve in their designated capacity until the July, 1954 Convention period.

The meeting place was excellent—the group holding two sessions, one on the patio of Greenlawn and the afternoon session at Candlewood Trails, at the home of Board Member Walter R. Meyer at Candlewood Lake. The weather was of the choicest Indian Summer variety and the Editorial Board is indebted to Dr. Meyer and to Enthone, Inc., for their gracious hospitality.

Sustaining Memberships

As a means of acknowledgment of branch efforts in the past and as an added incentive for branch activity in the procurement of new supporters of the AES. Research Program, it is planned to publish regularly in the columns of this journal a tabular summary listing each branch with its number of sustaining memberships credits. This summary will appear as soon as sufficient information is made available to Headquarters.

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A. E. S. INTERIM MEETING, ROYAL YORK HOTEL, Toronto, Ontario, February 13, 1954.

Delegates should make their own hotel reservations. Hotel officials advise that this be done no later than December 15, 1953.

Branch News

Coming Events

THIRD ANNUAL A.E.S. INTERIM MEETING, TORONTO

Saturday, February 13, 1954 has been designated as the date of the Third Annual Interim Meeting at Toronto, Canada. Other particulars:

Interim Meeting Headquarters:
Royal York Hotel
Time of Meeting: 10:00 a.m.

Delegates and others planning to attend this meeting should make their own hotel reservations before December 15.

Toronto, the host branch, states that it "will do everything within its power to make the visit of national delegates a pleasant one". All in all, the 1954 interim meeting promises to be as educational as it will be enjoyable.

The Executive Board earnestly seeks each delegate's assistance and hopes plans will be made to attend this important meeting. The tentative program:

TENTATIVE PROGRAM AND AGENDA

Time	*Item*
10:00–10:15	Opening Remarks
10:15–10:30	Finances
10:30–11:00	Membership and A.E.S. Facts
11:00–noon	Branch Officers' Manual
noon–12:30	Open
12:30– 1:55	Luncheon
2:00– 2:15	Executive Secretary's Report
2:15– 3:00	Editorial Board
3:00– 3:30	Broadening of the Society Base
3:30– 4:00	Research and Sustaining Membership, Process Control Handbook
4:00– 4:15	Advertising Manager's Report
4:15– 4:30	Delegates Handbook
4:30– 4:45	Nominations for Third Vice-President—Open
4:45– 5:00	New York City Convention Report
5:00– 5:30	Cocktail Hour

NOTE: This is only a tentative Agenda and Program. Any suggestions—additional agenda items or any other information—should be forwarded to members of the Executive Board or to Headquarters before December 15.

The final Agenda and Program will be sent to delegates before February 13.

DETROIT BRANCH

ANNUAL EDUCATIONAL SESSION AND CHRISTMAS PARTY

Hotel Statler, Detroit
Friday, December 4 at 8:00 P. M.
and
Saturday, December 5 at 7:00 P. M.
respectively

FRIDAY SPEAKERS

DR. WILLIAM BLUM, Honorary Chairman, presiding, will address the group with an illustrated talk on his Australian trip

DR. EARL J. SERFASS, Lehigh University, "Recent Development in the A.E.S. Research Program"

MR. WALTER L. PINNER, Houdaille-Hershey Corp., "Progress in Development of a New Accelerated Corrosion Test", representing activity of A.E.S. Research Project No. 15

DR. A. E. R. WESTMAN, Ontario Research Foundation, "A Metallographic Study of Some Steels Used for Nickel Plating", as developed in A.E.S. Research Project No. 14

NEWARK BRANCH

ANNUAL EDUCATIONAL SESSION AND CHRISTMAS PARTY

Friday, December 18 and Saturday, December 19, 1953, respectively
Robert Treat Hotel, Newark, N. J.

PROGRAM

HOWARD COBB, Aircraft Radio Corp., Boonton, N. J., Sound-film presentation

CLIFFORD STRUYK, General Chemical Division, Allied Chemical & Dye Corp., A timely subject

H. L. HOVIS, Chief Chemist, Hamilton Watch Co., Lancaster, Pa., "Plating on Small Parts for Instrument Manufacture"

ALLENTOWN-READING BRANCH

The first meeting of the 1953–1954 season was held on September 16, at 7:00 P. M. at Scotty's Anchorage, Emmaus, Pa.

The speaker for the meeting was MANSON GLOVER, President, Glover Coating Company, Inc., Malden, Mass., on the topic, "Getting Your Money's Worth Out of Your Tank Lining".

JOSEPH E. MCKEONE, *Librarian*

ALLENTOWN-READING BRANCH

The season's second monthly meeting took place on October 21 at 7:00 P. M. at Scotty's Anchorage, Emmaus, Pa.

The speaker for the meeting was ARTHUR S. KOHLER, technical director, Frederick Gumm Chemical Co., Inc., Kearny, N. J. His topic was "Barrel Burnishing".

JOSEPH E. MCKEONE, *Librarian*

BALTIMORE-WASHINGTON BRANCH

On October 13, at 8:00 P. M., a meeting was held at the National Bureau of Standards, Washington, D. C.

After a short order of business during which DR. ABNER BRENNER was appointed Chairman of the Educational Committee of the 1956 Convention, the balance of the evening was spent listening to a very interesting and informative talk by DR. BLUM about his trip to Australia and New Zealand. This talk was well illustrated by a series of Dr. Blum's excellent Kodachrome slides.

CARL THIEDE, *Secretary*

BOSTON BRANCH

A regular meeting was held on November 5, at the Hotel Statler. Speaker for the evening was JOHN B. WINTERS, Vice-President, Research, R. O. Hull & Co., Rocky River, Ohio.

His subject was "The Use of a Hull Cell in Control and Trouble Shooting". The December meeting will feature a movie on corrosion and a talk on nickel by ROBERT MCKAY of the International Nickel Company.

GEORGE P. SWIFT, *Secretary*

BRIDGEPORT BRANCH

The annual picnic outing of the Branch was held August 22, at Boothe's Estate in Stratford, Conn.

Once again, ideal conditions prevailed. More than 90 members and guests, and over 30 children were in attendance.

Badminton, volleyball and croquet were offered to the sports lover, as well as a pickup game of softball. The Peddlers, at the last scoring, were ahead 97–12. However, a rally by the Platers in the last half, of the last inning, which netted more than so many runs, was squelched by the introduction of a "ringer", a speedball merchant, who was neither Peddler nor Plater, but effectively brought the bacon home for the winners.

The committee, headed by HUGH MORRIS, wishes to thank everyone for their contribution toward making the affair a success.

A regular business and educational session was held on September 11, in the Main Ballroom of the Hotel Barnum. President Consalvo called the meeting to order at 8:30 P. M. at which time 33 members were present.

Two applications for membership were accepted: Edmund Owen, Stratford, Conn., Arthur W. Martin, South Norwalk, Conn., and one new member was elected: Otto Levens, Bridgeport, Conn.

The death of S. Suhanosky's son was reported.

At 8:30 the meeting was turned over to Librarian Robert Bonazzo, who introduced Dr. Swift, President of the A. E. S. Dr. Swift took us through the workings of the society at the national level. He stressed the desire of the presiding officers to point their activities of the Society toward the needs of the backbone of the Society—the Branches.

At 9:30 the meeting was adjourned, and refreshments were served with Mr. Gillette, of Baker Bros., Boston, acting as host.

Bob Parker, *Secretary-Treasurer*

CHICAGO BRANCH

Chicago Branch reports that approximately 60 members enjoyed R. W. Landon's presentation of the subject of "Electroless Nickel Plating". The Branch wishes to extend its best wishes to Dr. G. Gutzeit, of General American Transportation Company, who was originally scheduled to present this subject at the October 9 meeting but unfortunately was hospitalized and could not be present.

Mr. Landon, also of the Kanigen Division of General American Transportation, presented the subject in an interesting and informative manner by outlining the operating conditions, the equipment needed and the types of metals as well as other materials which can be coated with "Kanigen". Considerable interest in the process is indicated by the fact that more than three thousand requests for information have been received by General American Transportation since their publicity was released last spring.

A lively discussion period followed the talk. Mr. Landon was ably assisted in answering questions by Dr. R. T. Griffith, W. J. Crehan, and R. J. Doubek, all of the Kanigen Division of GATCO, and by Don Matheny of their research and development laboratory.

At the business meeting, held just prior to the technical session, progress reports were made by various committees, including a report on the status of a project for setting up a permanent exhibit of electroplating at Chicago's Museum of Science and Industry. Ed Stanek's report on the activity of the Annual Banquet Committee indicates that members can look forward to being well entertained as well as educated at the meeting next January.

Jerome Kuderna, *Publicity Representative*

CINCINNATI BRANCH

The meeting opened with 40 members and guests present. President Truman introduced and welcomed the visitors.

A discussion was held concerning the election of a new treasurer to replace Charles T. Nuzum who has left the area to accept employment in Bradford, Pa. Gordon T. Speers was elected to fill the vacancy.

Ezra Blount reported on the result of his visit to Indianapolis Branch to discuss a regional meeting. He reported that Indianapolis would continue their annual dinners but were in favor of a regional meeting and that they had appointed Herb Kennedy as their representative to meet with any committees for the regional meeting. William D. Gordon reported that Louisville was favorable but worried about financing such a venture. They asked for time to consider the matter.

R. D. Miller reported that Columbus was favorable but did not have enough members present to make any decisions. Blount reported that Dayton appointed Elmer Rehme to represent the branch in the matter. A letter from John K. Eastman, Secretary, Dayton Branch, was read stating the stand of their executive board on this matter.

A motion was passed that the Cincinnati Branch have an Annual Dinner Dance and Educational Session.

The application of John R. Holaday for membership was read and favorably acted on.

Charles Wise and Stewart Chipman were appointed to audit the branch treasury books.

It was voted to pay the Engineering Society out of the branch treasury the additional forty cents per member necessary to defray the expenses of operating the Society Building for meeting purposes.

D. S. Roland, Sarco Company, Inc., gave a very interesting and informative talk on "Temperature Control in the Plating Industry".

The social hour was sponsored by the Harshaw Chemical Company.

William Young, *Secretary*

CLEVELAND BRANCH

The second meeting of the season was held on October 2. Four applications for membership were received and accepted. The branch agreed to present a television program over a local station in 1954.

The speaker for the evening was G. E. Flower, Commissioner of Sewage Disposal for Cleveland. After describing the sewer system and the three disposal plants, Flower discussed the effects of various types of industrial waste on the sewage treatment. Three general types of trouble could be encountered: those caused by wastes, mostly of organic nature, which would increase the B.O.D. beyond the capacity of the sewage plant; inorganic wastes such as cyanide and chromium which affect the bacteriological processes; and gelatinous wastes such as iron hydrate which impede filtration rate and obstruct aeration devices. In Cleveland the storm sewers also empty into the disposal plant causing considerable dilution. For this reason Flower was of the opinion that plating wastes if discharged slowly would not be objectionable in Cleveland. He pointed out, however, that the State has control over wastes going into streams and lakes and the restrictions in this case are necessarily much more rigid.

A. H. DuRose,
Assistant Librarian

COLUMBUS BRANCH

The meeting was called to order by the new president, Dale Evans.

Walter Denny gave a short talk about the exhibits which were shown at the convention. There were about ten branch exhibits for which Columbus was awarded first prize. Walter, himself, won third prize on the individual exhibits shown. He then distributed some very good photographs which he had taken of the exhibits and the Convention in general.

R. D. Miller, Cincinnati Branch member, was then introduced. He extended an invitation to the Columbus Branch in sponsoring an annual regional social and technical gathering. Other branches to be contacted were Dayton, Indianapolis and Louisville.

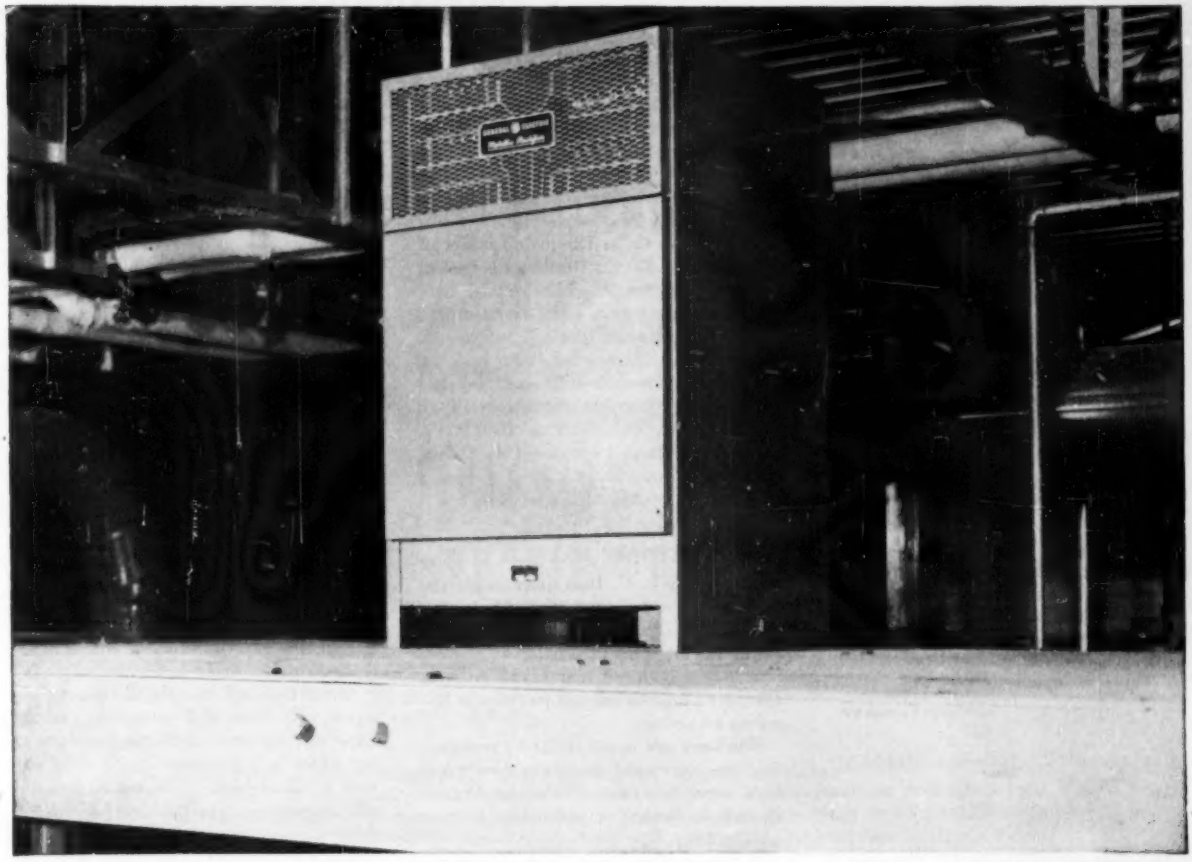
The Cincinnati Branch itself held such a meeting last year which was quite successful, both socially and financially. After some discussion, it was suggested that the secretary contact all members of the Columbus Branch and urge them to express their views on the matter.

Marvin Pingle, Westinghouse Electric Corporation, then gave an interesting and enlightening talk on the new Westinghouse plant at Columbus. He not only covered all the phases concerning finishing operations, but also the total production expected and future plans.

Refreshments were then served by Mike Farr. There were 19 members and four guests present.

The October meeting was called to order by President Dale Evans, who called for a discussion on the joint regional. Dick Jager, who attended the Cincinnati meeting last year, gave a brief description of what transpired at that meeting. He stated that he was in favor of such a meeting and stressed the point that it should not be held for the sole purpose of money making.

Bill Neill then gave the background of the regional meeting move. The idea is not new. In 1940, Cincinnati, Dayton and Indianapolis began holding joint meetings each year. However, after two meetings, they were abandoned due to the high costs. Bill stated that he was in favor of holding such a meeting and suggested that a fund be established from



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Branch News

excess profits to form a cushion against possible failure.

CHARLIE FAUST then discussed the social advantages of holding such a meeting.

Dick Jager volunteered to represent the Columbus Branch at the organizational meeting called by the Cincinnati Branch. There were no dissenting votes against the joint meeting, so Dick carried with him the full support of those present.

The following applicants were elected to membership: DOUGLAS GORDON, North American Aviation Corporation; MARVIN PINGLE, Westinghouse Electric Corporation; and RICHARD B. LOSE, Oakite Products, Inc.

LIBRARIAN JIM ZELEIN then introduced E. G. SCHROEDER of the Electric Products Company of Cleveland, Ohio. Schroeder presented an interesting discussion concerning the use and maintenance of motor generator sets and rectifiers. After the talk, refreshments were served by MIKE FARR to the 25 members and 4 guests present.

HARRY L. MOORE,
Secretary-Treasurer

DALLAS-FORT WORTH BRANCH

The branch started its first meeting after a summer recess with a good attendance and a very interesting speaker. Thirty-one members and visitors were in attendance, which was encouraging and many of the visitors made out application forms for membership in the branch. A report was made by the secretary on names of those who have failed to pay their dues and thus liable to be dropped from the membership. A report was also given on the branch 's financial status.

Speaker for the evening was KING RUHLY, Sales Manager, Michigan Chrome & Chemical Company, Detroit, Mich. Ruhly gave a very instructive talk on electroplating tapes and stop-off materials. A question and answer session was an interesting part of this meeting as members had many questions to ask about their individual plating problems.

R. H. HEPPEL, *Librarian*

DAYTON BRANCH

The branch held a dinner meeting on October 14 at Pappy's Kitchen Klub with 25 members and guests present. During the business session SOCIAL CHAIRMAN RAY COY announced that the Ninth Annual Educational Session and Dinner-Dance would be held February 27, 1954 at the Biltmore Hotel. He reported also that plans to hold an ice skating party at Troy's Hobart Arena are under consideration.

It was announced that the Dayton Branch will not actively participate in the Tri-State Regional Meeting being sponsored by the Cincinnati Branch in April.

The membership list continued to grow with the acceptance of applications from JOSEPH KEPLINGER, Moraine Products Division, G.M.C.; ROBERT WORLEY and CHARLES BENSON, both of Delco Products Division, G.M.C.

LIBRARIAN HOLLE LUECHAUER introduced JOHN EASTON who gave a short talk on "Anodizing Processes at the National Cash Register Co". The main speaker of the evening, E. C. RINKER, Technical Director, Sel-Rex Precious Metals, Inc., was then introduced. He discussed his paper, "Bright Gold Plating", which was published in the August, 1953 issue of PLATING. After the talk each member present received a gold plated souvenir.

The meeting adjourned at 10:05 and a social hour followed sponsored by United Chromium, Inc.

JOHN EASTON, *Secretary*

DETROIT BRANCH

PRESIDENT L. C. BORCHERT called the meeting to order at 8:15 P. M. in the Michigan Room of the Hotel Statler, with about 140 members present.

It was announced that L. M. MORSE, Chrysler Corporation, will be the new Research Chairman.

Fourteen new applications for membership were reviewed and these new members were duly voted into the Detroit Branch. Branch membership is now around 520.

PROGRAM CHAIRMAN FRED OLMSTEAD presented the film of the evening, "Industrial Album", by Frederic B. Stevens, Inc. The film depicted primarily the Steven's small parts automatic plating and processing machine.

Following the film, the main speaker was presented: J. W. HENSLEY, Manager, Nucleonics Laboratory, Research and Development Division, Wyandotte Chemicals Corporation.

Hensley's talk covered "Radioactive Tracers Track Metal Cleaning Effectiveness" and was similar to his presentation published in PLATING, April, 1953.

The meeting was adjourned at 10:00 P. M. and the fellowship continued after the meeting with the serving of beer and pretzels.

JOHN C. DRINKWATER,
Publicity Chairman

HARTFORD BRANCH

A regular meeting was held at the Bond Hotel on October 19 and 77 members and guests were present. Preceding the meeting, a color movie, "The ABC of Hand Tools", was shown. After the movie, GEORGE HOGABOOM eulogized HONORARY MEMBER E. M. STEPHENSON who had passed away recently. Mr. Hogaboom then spoke briefly on the latest developments in the plating field.

Guest speaker for the evening was Hartford's member, C. F. ROBISON, Harshaw Chemical Co., whose subject was "Trouble Shooting in the Plating of Nickel".

Robison first spoke briefly on how the removal of controls on nickel would affect the plating industry and then went on to cite many of his experiences over the years in trouble shooting on nickel baths. He spoke on the bath composition and the use of regular analysis for proper maintenance. Problems of proper equipment were brought out such as tank linings, filters, use of correct filter aids and what may be removed by their use. Correct positioning of the lead heating coil was cited and the method of dummying the solution at 2 to 4 amperes per square foot for the removal of metallic impurities were discussed.

WALTER ACKER was technical chairman for the evening.

STANLEY PLATOZ, *Secretary*

INDIANAPOLIS BRANCH

The Columbus members of the Indianapolis Branch were hosts for the October 7 meeting. Ninety-four members and guests enjoyed a steak dinner and program at the Arvin Industries cafeteria.

At the business meeting the secretary's report was read and accepted. HERB KENNEDY reported on the regional meeting which will be either April 3 or 10, 1954 in Cincinnati. Indianapolis Branch will continue to have its annual dinner-dance in the spring.

One new member was voted into the Society, KENNETH H. BENNETT, Udylite Corporation. There was one member transferred to the branch from Chicago, EVERETT H. BABCOCK.

The program was a group of musicians from Camp Atterbury under the direction of LIEUTENANT BENSON. The master of ceremonies was RALPH ROSE of Los Angeles. Included were the "Five Kings" who sang; STAN SILVERS, harmonica; GEORGE ROGERS, soloist; PAUL GAYLORD, soloist; and MALCOM SHERWOOD, piano. The variety of the program pleased everyone.

EDNA ROHRABAUGH, *Secretary*

JACKSON-LANSING BRANCH

The branch held its first meeting of the year, September 12, in the form of a stag golf day at the Arbor Hills Country Club, Jackson, Mich. Arbor Hills is a pleasant and sporty 18 hole course but the day was ruined for the golfers by being cold, windy, and rainy. However, numerous card games and bull sessions took over. About 125 members and friends of the branch remained to participate in a swell chicken dinner and the distribution of prizes. No complaints have been received on details of the day's activity.

The regular October meeting was held at the Hotel Porter in Lansing, Mich., on the 13th. After a nice dinner, enjoyed by all, R. W. REDMOND led a discussion of surface preparation of steel, prior to

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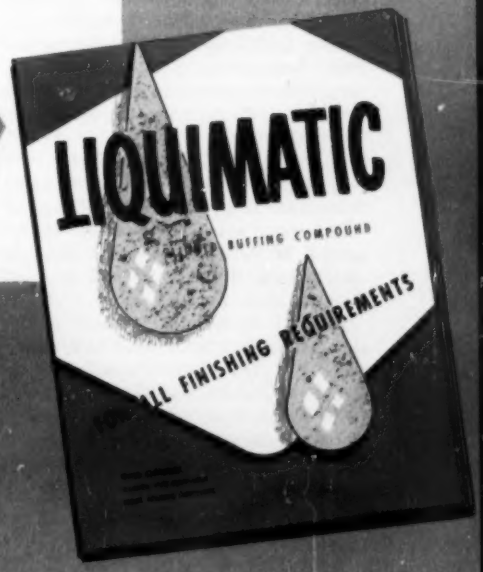

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electroplating. Movies covering manufacturing of cameras ended the program.

R. W. REDMOND,
Publicity Chairman

LOS ANGELES BRANCH

The application of dry disc rectifiers to plating was discussed in a talk at the regular monthly meeting by R. C. SCOTT, Chief Electrical Engineer of the Udylite Corporation.

Scott stated that there are only three types at the present time that are economically practical: copper oxide, magnesium copper sulfide and selenium, the last named being perfected only recently to compete with the others of the industry.

He continued that it has been determined that a high ripple content will have direct bearing on plating results, therefore it is advisable to select a rectifier with 5 per cent ripple since they can be used for all types of power source. Scott concluded that where regulators are required, they may be added in the same cabinet or supplied as a separate unit to be located at a different point than the rectifier. There are many variations of possible control and each one should be studied from a practical and economical standpoint to determine what is the best way of handling the job.

The business session was presided over by PRESIDENT JOHN MILLHORN. A record attendance of 103 members and guests were present. The increased attendance was due to the great effort of MEMBERSHIP CHAIRMAN STUART KRENTEL in sparking a membership drive which appears to be very successful. Guests were introduced by the Sergeant-at-Arms and eight new applicants for membership were introduced. One new applicant was installed.

A letter from W. L. PINNER, International Council Representative, was read by the Secretary asking the members to submit manuscripts to be used at the Fifth International Conference which is being held in London in April of 1954.

L. TRUMAN STONER, *Secretary*

LOUISVILLE BRANCH

A regular monthly meeting was held September 17 at Korfhages Restaurant with a dinner served at 6:30 P. M. PRESIDENT P. H. PATE opened the business and open meeting at 8:00 P. M. with 28 members and guests present.

STANLEY J. BEYER, Chairman of the open meeting, after a brief talk, introduced I. A. LEE, of the Rectifier Department, General Electric Company, Lynn River Works, Lynn, Mass., as the speaker of the evening. Lee spoke on the subject of rectifiers including the advantages of rectifiers over generators which may be summarized as follows:

Rectifiers have in the past few years of operation proved to be the ideal d-c source for plating departments be it a large or small operation.

Considerable savings in the cost of electrical power now being used in the plating operations are made possible by use of rectifiers.

The cost of maintenance of rectifiers over generators has been considerably reduced over a large margin.

Rectifiers have had considerable improvement over the old models and now have stacks liquid cooled and hermetically sealed.

Considerable discussion followed and the speaker was given a rising vote of thanks for a very interesting talk.

President Pate called upon BILL YOUNG, Secretary of the Cincinnati Branch, to give the Louisville members a talk on the proposed regional meetings to be held in conjunction with the Cincinnati, Dayton, Columbus, Indianapolis, and Louisville branches as participants. Young stated that he would like to get the thinking and opinion of these branches to see what can really be accomplished to further such a plan. After some discussion, President Pate stated that we will try to have an answer at the next branch meeting.

RAYMOND M. SCHOCK, Executive Secretary of the National Association of Metal Finishers, Inc., then gave some very interesting news in a talk, "News Behind the News".

WILLIAM B. DRAKE was elected to membership in the society, and RICHARD G. MARSHALL transferred from Dayton to the Louisville Branch while R. KEN MARTIN transferred from Louisville to Grand Rapids.

President Pate announced the appointments of the following people to the standing committees:

Membership Committee: JOHN SCHOLL, Chairman, and RAY MCDANIELS
Sick Committee—WM. W. FRANCIS, Chairman, and KENNETH REIFSTECK
Publicity Committee—J. G. STERLING, Chairman, and ALBERT SEIDLE
Educational Committee—STANLEY J. BEYER, Chairman, and RAY SHALLCROSS

Meeting adjourned at 10:30 P. M.

JOSEPH G. STERLING,
Secretary-Treasurer

MELBOURNE BRANCH

The 82nd regular meeting of the branch was held October 15 at Chemistry Theatre, Melbourne University, with PRESIDENT G. WALKER and 28 members and visitors present.

After acceptance of two new members, the speaker for the evening, PROFESSOR A. N. HAMBLY, was introduced. The Professor's lecture, "A Brief Review of the Structure of Matter", was opened with an explanation of the three major states of matter: crystalline, liquid, and gaseous.

With the aid of scientific equipment and actual samples of rock strata, the crystalline form was explained. Slides were screened to demonstrate crystal structure under polarized light.

Liquid and gaseous matter also were explained by the use of slides. The screening of an interesting film, "Molecular Theory of Matter", by Chicago University completed the evening's program.

At the end of the lecture, J. DALE proposed a vote of thanks to Professor Hambly, whose presentation was one of the most interesting heard by Melbourne branch members. Meeting closed at 10:00 P. M.

S. B. PEARCE, *Secretary-Treasurer*

MILWAUKEE BRANCH

A regular monthly meeting was held on October 2 at the Ambassador Hotel, with 22 members enjoying the usual premeeting speakers' dinner.

PRESIDENT F. ANDERSON gavelled the meeting to order with 56 members and guests present. Two applicants were accepted and a short business meeting followed. A discussion on the possibility of holding a future Convention and Exposition in Milwaukee was postponed until the next regular meeting.

ASSISTANT LIBRARIAN ART LINN introduced the speaker, F. L. SCOTT, United Chromium, Inc., who spoke on "Organic Coatings Over Plated Surfaces". Development of clear organic coatings over chromium were emphasized by the speaker and exhibits of these were shown. A question period after the talk brought forth comments on the spray application of plastisols on ducts, hoods, tanks, and fans used in the plating room.

Scott's talk was the first in a series of planned educational sessions regarding other types of finishing such as painting, polishing, anodizing, metallizing.

Refreshments were served through the courtesy of United Chromium, Inc., and then the meeting was adjourned.

C. PETER, *Assistant Secretary*

NEWARK BRANCH

A regular meeting was held on September 18, at the Robert Treat Hotel.

Previous to the meeting, 28 members and guests enjoyed an excellent dinner.

Movies were shown at 8 P. M. by HOWARD COBB and the regular business meeting was called to order at 8:45 P. M. by PRESIDENT ROBERT HORROCKS.

Applications were received from MARTIN A. BLUMENFELD and P. PETER KOVATIS while JOSEPH G. SCHMERIN was elected to membership.

Transfers were announced as follows: WILLIAM TREADWELL from Rochester, DOUGLAS L. CARLE from Pittsburgh, and OTTO KARDOS from New York.

The resignation of ANTHONY NIOSI was recorded.

Reporting Convention highlights, DON FOULKE, AL SQUITERO, WARREN MCMILLAN and CHARLEY CHALFANT each

reported on Convention papers not yet printed in PLATING.

LOUIS DONROE then conducted a question and answer period.

GEORGE REUTER,
Recording Secretary

NEW YORK BRANCH

The September 26 meeting was called to order by PRESIDENT A. AMATORE.

The following men were elected to membership and duly installed: R. MORRISS, J. VAN ROHR, C. MARTIN, P. CARUTA, C. ANTMANN, and A. GLASSI. The following transfers were read and accepted: S. ROSENBLATT (Providence) and W. JEFFERIES (Chicago).

The meeting was turned over to LIBRARIAN P. VIET, who outlined a few of the highlights of the coming educational meetings for 1953–1954. There was a short question and answer period followed by "Can you top this", which was started by D. CLARIN.

The October 9 meeting was called to order by President A. Amatore. The minutes of the previous meeting were read and approved.

The meeting was turned over to G. HERRMANN, acting librarian in the absence of P. Veit. He presented A. EHRENSBERGER of F. B. Steven's, Inc.

Ehrensberger included the presentation of a film with his speech, showing the modern productive techniques in "Automatic Polishing".

LESTER LEVINSON,
Recording Secretary

PHILADELPHIA BRANCH

The first meeting of the new season was a dinner meeting at the Broadwood Hotel on September 25; 55 attended.

As this meeting featured the annual George Gehling Memorial Lecture, ALBERT HIRSCH, attending his first meeting since his recent serious illness, preceded the speaker with a few reminiscences of his many years of close association with the late George Gehling. LIBRARIAN D. P. VOLINO then introduced WALTER L. PINNER, Houdaille-Hershey Corp., who delivered the lecture, "Unsolved Problems Facing the Metal Finishing Industry".

He congratulated the branch on its Convention success and also commented on the well-deserving reward for DR. SAMUEL HEIMAN, Convention general chairman, in being elected Supreme Third Vice-President.

In his talk, Pinner posed eleven unsolved problems confronting the plating industry, the solution of which would be of benefit to all engaged in the many phases of plating. A spirited discussion followed the talk, with timely remarks by Dr. A. K. GRAHAM, MYRON DIGGIN, Dr. Heiman, and others.

A short business meeting followed.

The October 23 meeting was held at the Franklin Institute; 45 attended. A short business meeting preceded the speaker. BRANCH PRESIDENT OTTENS explained the change of policy in selecting the Franklin Institute and the Engineers' Club as the location for many of the forthcoming meetings. It was hoped that new surroundings, with varied programs, would attract greater meeting attendance. One new active member was admitted.

Librarian Don Volino introduced J. GORDON SEITER, F. J. Stokes Machine Co., whose subject was "Vacuum Metallizing". Seiter exhibited samples of representative parts finished with aluminum applied by vacuum metallizing and described the processes involved using slides to illustrate the various steps and equipment. Metals other than aluminum may be applied by this process.

The meeting adjourned at 9:15 to the Dairy Dell, where the boys lingered long over delicious Danish pastry, coffee, and ice cream served through the courtesy of Maas & Waldstein.

I. WM. MARCOVITCH, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

A meeting was held at the Providence Engineering Hall on October 19 at 8:30 P. M.

DONALD M. ANDERSON was elected to membership. After a short business meeting, LIBRARIAN JOSEPH SMITH, JR., introduced the guest speaker for the evening, LEWIS KRAMER, who chose for his topic, "Schooling Aspects in the Jewelry Industry".

The speaker is assistant principal of Mt. Pleasant High School, and at the present time is teaching a course in electroplating at the University of Rhode Island Extension School.

Kramer reviewed the present course at the school and also went into great detail in the plans the school has for training personnel for the jewelry industry. The school plans vocational training in design, tool-making, and electroplating, sponsored by the AES and the New England Jewelers' and Silversmiths' Association in cooperation with the Providence school system. The State Department of Vocational Training is designed to provide the growing industry with a steady supply of trained personnel, and to provide jewelry factory employees with an opportunity to improve their skill and status. Classes will be held at Central High School, Providence, and will continue from one to five P. M. on Mondays through the end of the school year in May.

Instructors versed both in technical and practical sides of the three courses have been assigned. Jewelry plant workers will be selected for training by their employers and will be paid for the time they spend in classes.

As to be expected, a very lengthy question and answer period followed. The meeting adjourned at 10:30 P. M. with 25 members present.

HENRY SHAVIER, *Secretary*

ROCHESTER BRANCH

A meeting was held on October 19 at the 40 & 8 Club. Discussed at the business session were items concerning the forthcoming annual branch Christmas party and dues payment procedures.

In the absence of the librarian, PRESIDENT JOHN LENZI introduced the speaker of the evening, WILLIAM BLACKMAN, Public Relations Director, Delco Appliance Division, G.M.C., who spoke on "Industrial Public Relations". Blackman pointed out the great concern held by his company as well as other well-managed companies toward relations between the company and the community and the company and its employees. He outlined the various means by which the company strived to maintain and improve its relations with the community and its employees. This talk was presented with the idea that platers, as well as members of other trades and professions, must be concerned with matters other than just those directly related to plating.

E. WALLIN, *Secretary*

SAN FRANCISCO BRANCH

A regular meeting was held at Gino's Restaurant, on September 17 with the call to order at 8 P. M. There was a short business session—two bills being presented for payment—one to reimburse MRS. JACK HITE for Christmas decorations for 1952, and the other in payment of the per capita tax. The first bill was voted to be paid, and the second bill, before being paid, was questioned by MR. PATTENGER in that we have not received dues from all members. The Secretary stated the per capita tax had to be paid in any event and he also stated that he had notified the members who were delinquent. Mr. Pattenger then suggested the Secretary follow the previously adopted resolution, viz: (members who were delinquent in their dues 90 days would be dropped from the roll).

A motion originated by CARL MATTMAN that the delinquent members be given a chance to pay their dues and that they be contacted by the Secretary by letter, and it was approved.

The meeting was then turned over to R. L. MCKENNA, General Fusing Corporation, Hayward, Calif., for his talk on "The Future of the Plating Industry". McKenna's talk held the attention of the members in that he spoke of price cutting and gave his views on "the somewhat unstable conditions that exist in the electroplating industry".

A discussion followed the talk covering standardization and suggested prices that should be charged for certain types of plating work.

HORACE J. SMITH,
Secretary-Treasurer

SPRINGFIELD BRANCH

The first monthly meeting of the 1953–1954 season was held on September 28, at "Blake's Restaurant", Springfield. There were about 25 members and guests present for dinner.

The first order of business was to decide on a definite monthly meeting place. It was decided by a majority vote to hold the regular meetings at the "Ivy House" on Route 5 in West Springfield, Mass. It also was decided to hold the October meeting in Pittsfield, Mass.

Three new members were presented and voted to membership: Ed Mish, P. V. Romano and W. F. Houlihan.

The speaker of the evening was Walter M. Kisner who spoke on "Vapor Deposition of Metals". This subject was relatively new to the majority of those in attendance and proved to be quite interesting.

Roger Heroux, *Secretary*

ST. JOSEPH VALLEY BRANCH

A regular meeting was held at the Hotel Elkhart, Elkhart, Ind., on October 7. Twenty-six members and guests were present for the dinner and 34 attended the technical session.

The membership application of Arthur G. Wiegand, Manager, Miracle Chemical Co., Ft. Wayne, was recorded. President Wm. McDowell opened the meeting for a ten-minute discussion of current problems with the following questions and answers developing:

To Ralph Wysong's question: "What has happened to the Indiana State Stream Pollution Questionnaire"? Mr. LeFevre answered that the State Office of Conservation indicated that a practical approach is being worked out and that no rush directives will be issued for the control of plating room wastes. Three to four months will be required to analyze the questionnaire.

To J. G. Bayman's question on the set-up required for a small job shop to clear enamel over chromium the answers by Ralph Brouwer and Louis Ragué indicated that a very inexpensive method of spraying and drying could be set up.

Chet McDowell asked about nickel restrictions. Ralph Wysong and Walter Lockwood advised that Government restrictions would be lifted effective November 1 and that industry voluntary nickel allocations would probably be set up similar to the pre-Korea arrangements.

Librarian Duane Poucher then introduced the guest speaker, L. R. Davidson, whose subject was "Wet Tumble Finishing". He stated that tumbling should be done in a large diameter barrel since the cutting is done on the down slide of the material. An increase of 4 inches on the diameter will give as much as 15–25 per cent faster cut thereby reducing floor space and time cycles. Slow starting of barrels will reduce impingement. Hardness of cutting media is of great importance and depends on the metal to be finished. Softer types of media are now preferred because they give better cut and do not deteriorate as fast. For fast cutting an abrasive is added and for finishing, the stones are coated with the media to obtain more of a burnishing action.

A complete movable diagram of the barrel action illustrated the movement of the mass in the barrel. Samples of all grades of stone, abrasive and finishing material were used to explain the various points of importance for tumbling of a wide variety of parts and samples which were displayed.

After the presentation of the subject, Davidson answered many questions from the floor including methods used for chip separation, prevention of nesting, technical questions about relative hardness of stones, and the action of cutting and coatings on the stone.

The meeting adjourned at 9:45 P. M.

Eugene Roth, *Secretary-Treasurer*

TORONTO BRANCH

President Cameron opened the first meeting of 1953–1954 season which was held at the Royal York Hotel on September 11 with 41 present.

The speaker, Trevor Forbes, Behr-Manning Corporation, Brantford, Ontario, gave a very interesting and informative talk on polishing with abrasive belts. He discussed the advantages of belts over polishing wheels, the different types of belts and contour polishing with belts.

The season's second meeting was held on October 9. The speaker was F. E. P. Griggs, Sales Manager, Canadian Hanson & Van Winkle Company, Ltd., who talked on the various types of degreasing solvents presently being used by industry. He discussed in detail the use and application of trichlorethylene blended solvents, diphase cleaners and ultrasonic degreasing.

Of particular interest were the newly developed complex blended solvents which have a uniform boil off and the flash point remains the same. These solvents are particularly useful in the aircraft industry for the removal of carbon, dirt, or paint from aluminum without attacking the aluminum. They will also strip chlorinated rubber-base paints which alkali strippers will not touch. They are an excellent substitute for carbon tetrachloride which is toxic.

At the business session, the application forms for Tapani Palvio and Lester Tompkins were read and passed; the National Convention report was given by Harold Bunting, and Ted Blandy read the financial report.

(*Continued on page 1437*)

HERE'S THE ECONOMICAL ANSWER TO YOUR ACID-PROOF HOOD and DUCT REQUIREMENTS

Typical Rigidon Solid Plastic Duct Sections Ready to Install

Put RIGIDON Solid Plastic Hoods and Ducts to Work in Your Plant For Longer Service Life

- **Acid Protection Inside and Out.** No need to be concerned about lining failure.
- **Easy to Install.** Although strong as light gage steel, these ducts are light in weight and easy to install.
- **Good Chemical Resistance.** Will resist practically all chemical conditions and high temperatures.
- **Round or Rectangular.** Easy to replace present system.
- **Low Initial Cost.** Standard designs and production know-how results in lower cost to you.

WRITE TODAY for Illustrated Bulletins No. 752, 753 and 754 on Solid Plastics.

Products of Heil Process Equipment Corp. are sold by all leading Electroplating Jobbers.

CHEMICAL-PROOF LININGS · TANKS HEATERS PLASTICS

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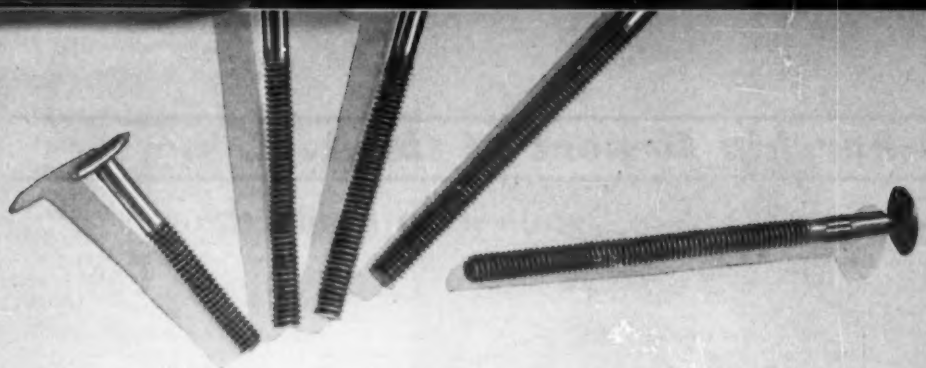
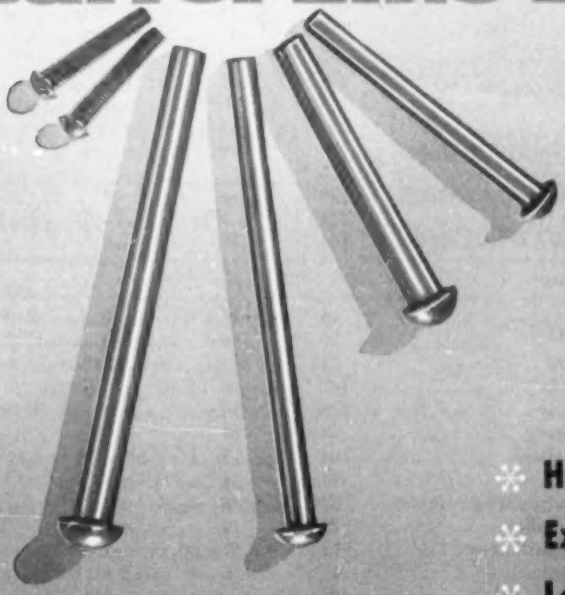
Other Heil Products Include: Lined Process Tanks • Plastic Fabrications • Lead Anodes • Immersion Heating Units • Lined Pipe and Ducts • Acid-proof Maintenance Materials



TWO NEW
Barrel Zinc Brighteners



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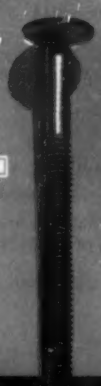
with

- ✲ **High Brilliance and Depth of Color**
- ✲ **Excellent Covering and Throwing Power**
- ✲ **Low-cost Operation**

. . . simple, economical methods for producing brilliant zinc deposits on barrel work. These Promat processes will last longer and cost less to use.

Promat B-4 and B-4M Brighteners have been fully proven in production. Several large barrel plating companies have been using them for months with great success.

The average cyanide zinc plating solution can be converted relatively easily to either of the Promat Barrel Zinc Brightener Processes. For full details just drop a line to Promat. Our service organization is ready to serve you at any time, on any plating problem.



PROMAT
DIVISION

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851 S. Market St., Waukegan, Illinois

Membership Report of the A. E. S.

Elections

CLEVELAND: Donald G. Brenner, John W. Edwards, John C. Malejan, Henry J. Skelley, Jr.
DAYTON: Charles P. Benson, Jr., Joseph A. Keplinger, Robert C. Worley
DETROIT: Donald H. Becking, Henry H. Blizzard, Francis J. Brennan, Henry Brown, Roland C. Chavey, Chester G. Good, Lawrence A. Hafeli, Roy W. Klein, Harold Merritt, Charles B. Murphy, David Saporta, Thomas F. Stapleton, Richard L. Teno, Aloys E. Weber
HARTFORD: Richard S. Blake, William E. Gilroy
HOUSTON: Kenneth L. Keppler
INDIANAPOLIS: James E. Abel, R. Glen Miller, James D. Powell, A. E. Smith, Robert R. Smith
LOS ANGELES: Ira Hayes
MILWAUKEE: Thomas E. Neubauer, Phillip H. Wiegand
PHILADELPHIA: H. Ralph Maack
ROCKFORD: Thomas A. Brennan, Jr., Jack T. Dunn, Grant Williams
SAN FRANCISCO: Arthur J. King
SYRACUSE: Ivan W. Allis
TWIN CITY: Richard S. Carlstrom, Myron I. Doebler, Walt W. Edwards
MEMBER-AT-LARGE: Sarup Singh Gill, Calcutta, India

Reinstatements

DETROIT: Gordon T. Forsyth (returned from armed forces)
INDIANAPOLIS: John E. Hoff, Jr.
LOS ANGELES: Ray E. Baugh, James M. Carter, John Murrieta
MILWAUKEE: Stanley Mey, L. J. Moyes, Jerome Stowasser
NEWARK: Steve Yacus
PHILADELPHIA: Charles E. Atkinson, Joseph E. Rotchild
ST. JOSEPH VALLEY: Harold Sherk, William Spillman, Jr.
TOLEDO: Joseph DiSalle

Transfers

Joe Hoefer from Jackson-Lansing to Cleveland; Richard G. Marshall to Louisville from Dayton; Richard O. Watson to Grand Rapids from Detroit; Harold L. Wright from Baltimore-Washington to Philadelphia; Bert G. Allen from Chicago to Rockford; Walter J. Bogus from Cleveland to St. Louis; Henry P. DeWitt from Detroit to St. Louis; Richard L. Nyquist from Waterbury to St. Louis; George Cook to Chicago from San Francisco; A. G. Russell from Chicago to Twin City

Resignations

CLEVELAND: Russell F. Cahill, W. G. Cryderman, Robert E. Lamb, Milton S. Roush, Ralph R. Zulak
DETROIT: Frederick Parks

Membership Competition

BRANCH	Membership Apr. 1, 1953*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Los Angeles	236	28	+21½	+ 9.1
Cleveland	236	15	+ 9	+ 3.8
Detroit	504	30	+13½	+ 2.7
New-York†	352	22	+ 8	+ 2.3
Newark	251	8	+ 5½	+ 2.2
Chicago	477	16	+ 9½	+ 2.0
Philadelphia	198	17	+ 3½	+ 1.8
Grand Rapids	173	5	+ 3	+ 1.7
Toronto	146	4	+ 2	+ 1.4
Hartford	151	8	+ 1½	+ 1.0
Pittsburgh	142	3	+ 1	+ 0.7
Waterbury	130	6	+ ½	+ 0.4
Boston	155	..	.....	.....
Melbourne	169	16	− 2	− 1.2
Bridgeport	158	7	− 4	− 2.5
Milwaukee	164	16	−20	−12.2
Second Group				
Dayton	76	11	+ 8	+10.5
Montreal	80	8	+ 8	+10.0
Twin City	71	4	+ 2½	+ 3.5
Rochester	107	8	+ 3½	+ 3.3
Syracuse	128	16	+ 4	+ 3.1
San Francisco	74	10	+ 1½	+ 2.0
Saginaw Valley‡	103	5	+ 2	+ 1.9
Cincinnati	92	4	− 2	− 2.2
Sydney	82	8	− 2	− 2.4
St. Joseph Valley	78	6	− 2	− 2.6
Baltimore-Washington	93	7	− 3	− 3.2
Indianapolis	105	6	− 4	− 3.8
New Haven	100	..	− 5½	− 5.5
Providence-Attleboro	95	1	− 5½	− 5.8
Buffalo	106	1	−12	−11.3
St. Louis	109	8	−16½	−15.1
Third Group				
Springfield	57	10	+ 9	+15.8
Western Ontario	22	2	+ 2	+ 9.1
Rockford	63	5	+ 5½	+ 8.7
Houston	42	1	+ ½	+ 1.2
Columbus	52	1	+ ½	+ 1.0
Kansas City	46	6	0	0
Adelaide	52	5	0	0
Southeastern	50	2	0	0
Hamilton	25	..	.....	.....
Lancaster	69	..	.....	.....
Jackson-Lansing	61	..	− ½	− 0.8
Allentown-Reading	53	..	− 4	− 7.5
Dallas-Fort Worth	53	..	− 5	− 9.4
Toledo	56	3	− 7	−12.5
Louisville§	44	1	− 6½	−14.8
Wichita	41	3	− 9	−22.0
Outside Competition				
Portland	...	18	.....	.....
At Large	138	17	+14	.....
Total A. E. S.	6,065	378	+46	+ 0.8
Active Membership, October 31, 1953	6,111			

*Subject to correction. †, ‡, §Winners in first, second and third groups, respectively of 1952–1953 membership competition.

INDIANAPOLIS: William L. Baughan, Walter H. Blanck, William N. Cunnington, John A. Marshall, James J. Monagle, Robert E. Nance, Jacob Skogland, George H. Stinson, James W. Wilson
NEWARK: J. Edward Messer
SAN FRANCISCO: Earl Beeman
WICHITA: Russell Bogardus, Lee Graham, Thomas Neal, Harvey Shaw, William Simpson, James Springer

Suspensions

DETROIT: Roscoe Mallen
SAN FRANCISCO: Gaetano Pilara, C. W. Sullins
WICHITA: Elbert Guthrie, Adolph Hune, Seigmond Kindall, Clifford Letterman, Paul McCrackin, Bill Murray

Deaths

NEWARK: Lloyd S. Burns
ST. JOSEPH VALLEY: Walter F. Schaub

Branch News

(*Continued from page 1434*)

COMING EVENTS

The Interim meeting of the Supreme Society is to be held in Toronto, February 13. A general invitation is extended to all delegates to attend the regular dinner meeting of the branch on Friday, February 12.

May 1 has been reserved for the Annual Regional Convention to be held at the Royal Brock Hotel in Niagara Falls, Ontario.

The meeting adjourned at 10:30 P. M.

J. G. SMITH, *Secretary*

TWIN CITY BRANCH

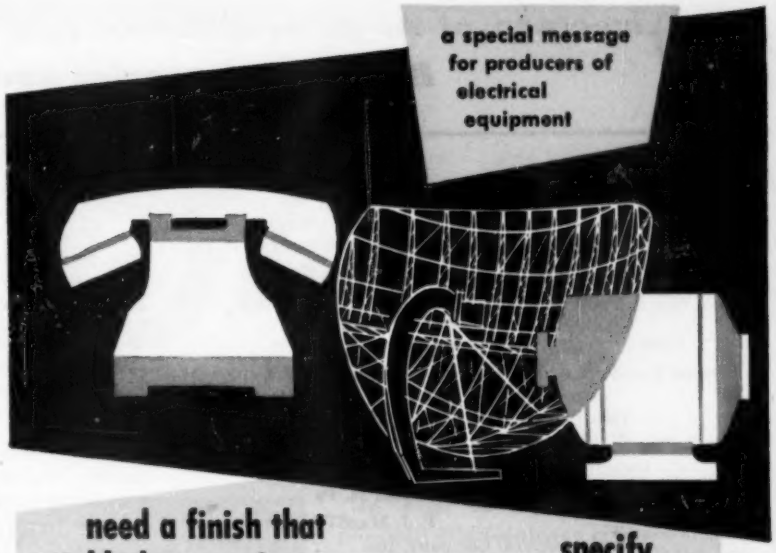
The branch met on October 5 at 7:00 P. M. in the Lodge Room of the Covered Wagon in Minneapolis with 32 persons present.

Following dinner PRESIDENT PAUL HESSE introduced three new members: WALT W. EDWARDS, RICHARD CARLSTROM, both of W. D. Forbes Company, and MYRON I. DOEBLER of Superior Plating & Rustproofing Company. The new members were welcomed into the branch by all present.

Following the short business meeting, ROBERT TEPLY introduced the speaker, WALTER POCOCK of the Allied Research Products, Inc., Baltimore, Md. Pocock's talk on chromate finishes for magnesium and aluminum was very interesting. It brought out the types of reactions which take place between the base metal or deposited coating and the various chromate conversion coatings and the results which would be expected thereof. Following the completion of his talk, Pocock was presented with a small gift on behalf of the Twin City Branch.

The meeting adjourned at 9:30 P. M.

ROBERT L. BUCKLEY,
Secretary-Treasurer



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Here's peak corrosion protection combined with conductivity, weldability and solderability. Here's a finish that holds paint firmly, prevents underfilm corrosion. Here's a line of attractive final finishes to add quality and sales-appeal. Here's Iridite . . . and here's how you can use it:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

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WEST COAST LICENSEE: L. H. Butcher Co.

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Directory of A. E. S. Officers and Research Chairman Branch Secretaries and Research Chairmen

A. E. S. OFFICERS

President.....Dr. G. P. SWIFT
53 Galen Street, Watertown 72, Mass.

First Vice-President.....Dr. R. A. SCHAEFER
Clevite-Brush Development Co.,
Division of Clevite Corporation
17000 St. Clair Avenue, Cleveland 10, Ohio

Second Vice-President.....CLYDE KELLY
Superior Plating Works
4600 Palmer St., Chicago, Ill.

Third Vice-President....DR. SAMUEL HEIMAN
Philadelphia Rust Proof Company
3221 Frankford Avenue, Philadelphia 34, Pa.

Past President.....F. J. MacSTOKER
Farrand Optical Company, Inc.
4401 Bronx Boulevard, Bronx, N. Y.

Executive Secretary.....P. PETER KOVATIS
445 Broad Street, Newark, N. J.

A. E. S. RESEARCH COMMITTEE

Chairman.....Dr. Earl J. Serpass
Lehigh University, Bethlehem, Pa.

Secretary.....The Executive Secretary

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Secretary, R. J. Down, Room 30, 17 Currie Street. Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Scotty's Anchorage, Second and Main Streets, Emmaus, Pa. Secretary-Treasurer, Norman H. Miller, New Berlinsville, Pa. Research Finance Committee Chairman, Malcolm G. Merkle, c/o General Electric Company, 1801 S. 12th Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Carl H. Thiede, 8426 Piney Branch Road, Silver Springs, Md.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research Finance Committee Chairman, Louis V. Gagnon, 53 High Street, Natick, Mass.

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Robert G. Parker, 25 Beverly Road, Trumbull 58, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary Eric G. Sampson, Jr., 43 W. Main Street, Falconer, N. Y.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary, Eric G. Sampson, Jr., 43 W. Main Street, Falconer, N. Y.

CHICAGO meets second Friday of each month at 6 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago 22, Ill. Research Finance Committee Chairman, Charles Geldzahler, c/o Platers' Technical Service, Inc., 509 S. Wabash Avenue, Chicago 9, Ill.

CINCINNATI meets fourth Wednesday of each month at 7:30 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, William Young, 7124 Montgomery Road, Cincinnati 36, Ohio. Research Finance Committee Chairman, C. R. Sorber, 2004 Connecticut Avenue, Cincinnati 24, Ohio.

CLEVELAND meets first Friday of each month in Hotel Carter at 8 P. M. Secretary-Treasurer, A. J. Lupien, 4408 Carnegie Avenue, Cleveland 3, Ohio. Research Finance Committee Chairman, to be appointed.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, Harry L. Moore, 505 King Avenue, Columbus 1, Ohio. Research Finance Committee Chairman, to be appointed.

DALLAS-FORT WORTH: Secretary-Treasurer, A. C. Fricke, 212 Julien Street, Dallas 8, Texas.

DAYTON meets second Wednesday of each month in the Biltmore. Secretary, John Easton, 641 Fairachers Drive, Dayton 9, Ohio. Research Finance Committee Chairman, Richard F. Moore, 526 Aberdeen Ave., Apt. B, Dayton 9, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, R. J. Racine, c/o Wyandotte Chemicals Corporation, Wyandotte, Mich. Research Finance Committee Chairman, L. M. Morse, c/o Chrysler Corp., Detroit, Mich.

GRAND RAPIDS meets second Friday of each month at Fingers Restaurant at 7 P. M. for dinner; educational session at 8:15. Secretary, John Dykstra, 720 Delaware, S. E., Grand Rapids, Mich.

HAMILTON BRANCH meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, R. Burke, c/o Swift Devices, 14 George Street, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond at 7:45 P. M. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

HOUSTON meets third Tuesday of each month at 6:30 P. M. in the Ben Milam Hotel, Houston, Texas. Secretary-Treasurer, Forest Baskett, 1240 Overhill, Houston, Texas.

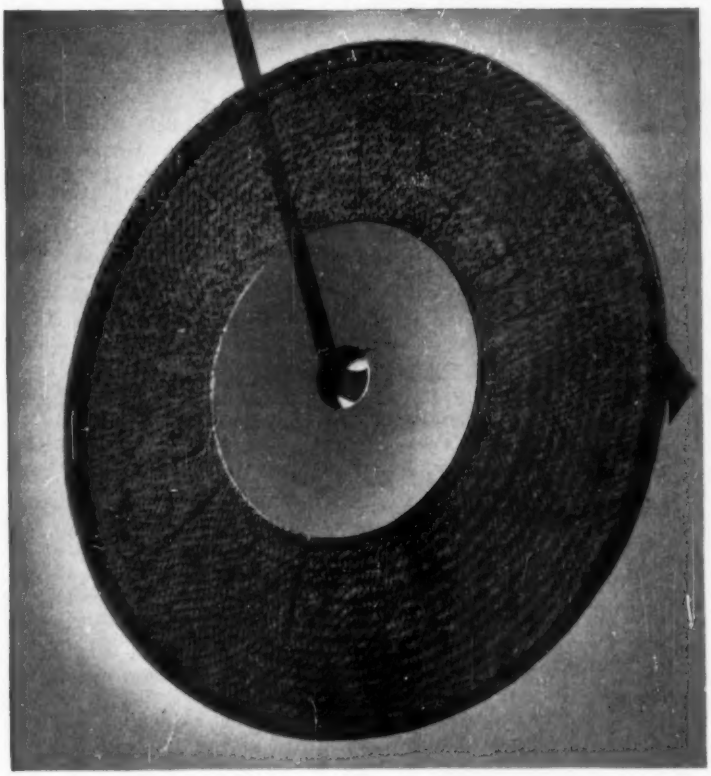
INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Miss Edna Rohrabaugh, 816 Robert Street, Lafayette, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Meadow Lark Inn in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. J. Bosca, 411 Third Street, Jackson, Mich. Research Finance Committee Chairman, H. McKlueen, 3617 McCain Road, Jackson, Mich.

KANSAS CITY—Secretary-Treasurer, Olin K. Bock, 5317 W. 58th Street, Mission, Kansas.

LANCASTER meets second Friday of each month at 8 P. M. September, December and April meetings are held at Hanover, York and Harrisburg, respectively; all other meetings at the Old Mill Inn, Lancaster, Pa. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

NON-FRAY *Blu-sisal* BUFFS



In order to eliminate the principal disadvantages prevalent in ordinary sisal buffs, CODMAN has developed a treated sisal known as BLU-SISAL.

The principal features of BLU-SISAL BUFFS are:

1. Blu-Sisal Buffs are treated for hardness to increase cutting qualities.
2. Blu-Sisal Buffs are treated in such a manner that the sisal fibres are bound together to eliminate excessive fraying.
3. And most important the Blu-Sisal Buffs are treated so that they hold compound.

Codman Blu-Sisal non-fray buffs are available from ten inches up. Ventilated if necessary.

Codman Blu-Sisal Conventional Buffs are available in all diameters.

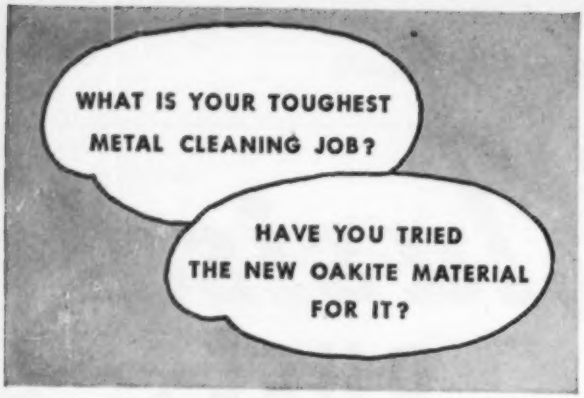
F.L.&J.C. CODMAN CO.

ROCKLAND, MASSACHUSETTS.

For over a half century, the Codman Company has been producing a most complete line of buffs and polishing wheels. During this period, Codman has pioneered in the development of products to meet the exacting needs of the metal finishing industry. This program has been possible because the efforts of the Company have been devoted **exclusively** to the design development and manufacturing of buffs and polishing wheels.

BRANCH OFFICES:

PHILADELPHIA · DETROIT · LOS ANGELES · GRAND RAPIDS



During the past year, the Oakite Chemical Research Laboratory has produced 16 new materials for performing the following metal cleaning and processing operations:

1 Heavy-duty cleaning in tanks
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3 Washing in pressure-spray machines
4 Electrocleaning zinc-base die castings
5 Putting heavy zinc phosphate coatings on steel in preparation for painting
6 One-operation cleaning, pickling and conditioning for painting
7 Stripping paint
8 "Killing" paint in spray booth wash water
9 Drawing and forming

One of these new materials may be the right answer for some problem that's been giving you a lot of trouble. Just circle the job number in the coupon, and let us tell you about the new chemical designed for the work.

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Send me a FREE copy of "*Some good things to know about Metal Cleaning.*" Also, give me more information about new Oakite materials for the jobs listed in your advertisement, as indicated by the numbers circled below:

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6 7 8 9

NAME _____

COMPANY _____

ADDRESS _____

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium. Secretary, L. Truman Stoner, 12427 Sproul, Norwalk, Calif. Research Finance Committee Chairman, Earl Coffin, 5102 Marburn Avenue, Los Angeles 43, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, Joseph G. Sterling, 1169 Keller Avenue, Louisville, Ky. Research Finance Committee Chairman, T. K. Allison, 2502 Manchester Rd., Louisville 5, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, S. B. Pearce, 11 Waterloo Street, Carlton, Melbourne, Australia.

MILWAUKEE meets first Friday of each month in the East Room, Hotel Ambassador. Secretary-Treasurer, E. E. Piellusch, 2921 S. 90th Street, West Allis 14, Wisc. Research Finance Committee Chairman, to be appointed.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary, J. T. Reisenburg, Jr., 996 Debullion Street, Montreal, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets third Friday of each month at 8 P. M. in Hotel Robert Treat. Secretary-Treasurer, George Wagner, Hy-Grade Electro Plating Company, 35 Fourth Street, Newark, N. J. Research Finance Committee Chairman, John Gumm, 538 Forest Street, Kearny, N. J.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in the Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, Milton Nadel, 41-15 50th Avenue, Long Island City 4, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets (unless otherwise stated). Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, to be appointed.

PITTSBURGH meets second Thursday of each month in the Avon Room of the Sheraton Hotel. Secretary, Wm. D. Wilson, 1167 Varner Road, Pittsburgh 27, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PORTLAND. Secretary, K. B. Humphrey, 1905 N. E. Saratoga Street, Portland 11, Ore.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Secretary, Henry Shavier, 32 Hodges Avenue, Taunton, Mass. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

ROCHESTER meets third Monday of each month at the 40 & 8 Club, 933 University Avenue. Secretary, Edwin Wallin, 70 Peach Tree Road, Penfield, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester 10, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, E. J. Budden, 122 Twelfth Street, Rockford, Ill. Research Finance Committee Chairman, David Stockton, The Udylite Corporation, 1943 Walnut Street, Chicago 12, Ill.

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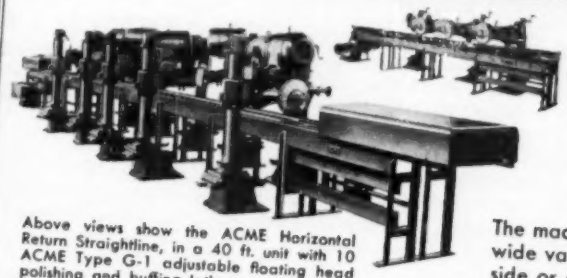
ACME *Semi-Automatics*

ACME Semi-Automatics are built to "deliver the goods." They can be fully relied upon to cut finishing costs, maintain production levels and stand up under long hours of operation!

The three ACME Semi-Automatics above are from left to right, the ACME A-2, a 2 spindle hand indexing machine for polishing and buffing cylindrical parts up to 12" diameter . . . the ACME L-4, a 4 spindle automatic indexing machine with a normal range of 250 to 400 indexes per hour . . . and the ACME D-10, an oscillating machine for finishing out of round parts. These machines are proved producers.

WRITE FOR CATALOG ILLUSTRATING WIDE RANGE OF TYPES



Above views show the ACME Horizontal Return Straightline, in a 40 ft. unit with 10 ACME Type G-1 adjustable floating head polishing and buffing lathes . . . and a 20 ft. unit with 3 ACME Type G-3 lathes.

ACME *Straight Lines*

ACME Straightlines provide effective solutions to many finishing problems. ACME progressive experience and engineering assure dependable performance at high production levels.

The machine illustrated is unusually versatile and adaptable to a wide variety of work. It may be loaded or unloaded from either side or either end. Polishing and buffing heads may be used on either or both sides and may vary in number to suit the required production and finish.

WRITE FOR OUR STRAIGHTLINE CATALOG ILLUSTRATING OTHER TYPES

ACME *Rotary Automatics . . .*

ACME 40" Rotary with 6 station indexing table and 4 ACME Type G-1 lathes with belt arm attachment. One second indexing time . . . up to 1800 indexes per hour. Acme Indexing Rotaries are available in table sizes from 18 in. to 10 ft. diameter.

ACME 10 ft. Combination Rotary . . . for continuous operation using 24 continuously revolving spindles or for 12 station indexing operation using every other spindle. One second indexing time . . . up to 1200 indexes per hour.

ACME 50" Continuous Rotary Automatic with 40 spindles equipped with 4 Acme Type G-3 heavy duty 15 H.P. polishing and buffing lathes with inverted spindles. ACME Continuous Rotaries are available with tables up to 24 ft. diameter.

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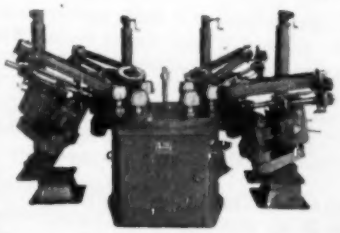

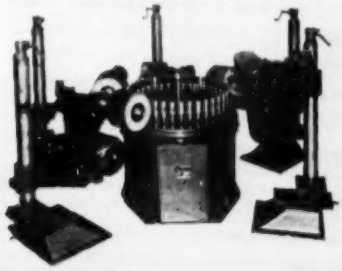

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ACME *Manufacturing Co.*

Builders 1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.
OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

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TIN-ZINC

is the ideal

LOW COST PLATE

for many applications

IN GENERAL PLATING, TIN-ZINC

1. is less than half the cost of cadmium.
2. has superior throwing power.
   - *means thorough covering of recesses — uniform covering of irregularities.*
   - *allows larger rack loads, no "shading" problem — savings again!*

IN ELECTRICAL EQUIPMENT, TIN ZINC

1. provides a deposit unsurpassed for permanent solderability.
2. offers excellent corrosion resistance.
3. produces a finish which reduces eye-strain on the assembly line.

No other finish has this unique combination of properties. If your operations lie in either of these fields, it will pay you to investigate TIN-ZINC today; write M & T for full information or technical assistance.

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—are protected, in an opaque fuzed quartz shell, against corrosive chemical fluids.

This permits use under conditions which inhibit the use of other type heaters.

NOTE THESE FEATURES

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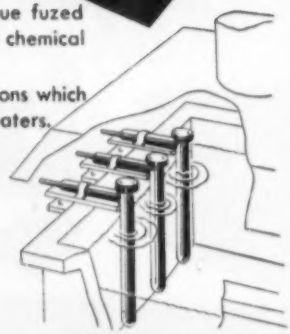

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Amersil Company, Inc.

1471 Chestnut Ave., Hillside 5, N. J.

2024

SAGINAW VALLEY meets for dinner at 6:45 P. M. and meeting at 8 P. M. at Zehnder's, Frankenmuth, Mich., second Wednesday of each month, September through May, except February. Secretary-Treasurer, Stewart Harger, 3214 Norwood Drive, Flint, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Elkhart Hotel, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 739 N. College Street, South Bend 28, Ind. Research Finance Committee Chairman, Ralph Brouwer, 361 Maple Avenue, Holland, Mich.

ST. LOUIS meets second Wednesday of each month at the York Hotel, 6th and Market, St. Louis, Mo. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, to be appointed.

SAN FRANCISCO meets second Thursday of each month, alternating between St. Julien Restaurant, 140 Battery Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Horace J. Smith, 319 Alta Loma Drive, South, San Francisco, Calif. Research Finance Committee Chairman, to be appointed.

SOUTHEASTERN meets second Friday of each month at the Belmont Steak House, Atlanta, Ga. Secretary-Treasurer, Charles A. Collings, P. O. Box 1088, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in the Ivy House, Route 5, West Springfield, Mass. Secretary, Roger R. Heroux, 1497 Longmeadow Street, Longmeadow, Mass. Research Finance Committee Chairman, Arthur Pearson, 102 Ely Avenue, West Springfield, Mass.

SYDNEY, AUSTRALIA meets second Thursday of each month at 7:30 P. M. in the Trust Building, King and Castlereagh Streets. Secretary-Treasurer, B. Bridgement, 19 Adelaide Street, Belmore, Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Richard's Restaurant. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman' George W. Cavanaugh, 129 Kenwood Avenue, Syracuse 8, N. Y.

TOLEDO meets first Thursday of each month at Park Lane Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Robert L. Edwards, 1106 Dovercourt Road, Toronto, Ont., Canada. Research Finance Committee Chairman, K. Wells, 370 Victoria Avenue, Toronto, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 6:30 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Company, 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, to be appointed.

WATERBURY meets second Thursday of each month in Elton Hotel. Dinner, 6:30 P. M.; meeting, 8 P. M. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Drawer B, Cheshire, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, K. W. Farquhar, 54 Napier Street, Ltd., Wallaceburg, Ontario, Canada.

WICHITA meets fourth Wednesday of each month at 6:30 P. M. at Lydroy's Eighty-one Grill. Secretary-Treasurer, Harry D. Burgess, 249 North Mosley, Wichita, Kans.

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DECEMBER 1953

LEA COMPOUND

Greaseless Composition for clean, effective and economical finishing on a wide variety of products.

For Polishing, Buffing, Burring, Satin Finishing; can be used on metals, plastic and wood.

CASE STUDY #1

Material: Brass.
Article: Escutcheon plates, and other builders' hardware.
Method of Forming: Wrought.
Final Finish: Imitation Butler silver.

Lea Method:

1. 120 grease set-up wheel.
2. Clean by acid dip.
3. Lea Compound Grade "N" on 10" diameter loose muslin buff 64/68 at 1800 r.p.m.
4. Nickel plate.
5. Lea Compound Grade "N" or "F" on 10" diameter loose muslin buff 64/68 at 1400 r.p.m.

Remarks: The Lea Method gave a better imitation of silver and materially lowered costs by eliminating cut-down buffing operation formerly used after the polishing step, and all cleaning and drying after final satin finishing operation.

CASE STUDY #2

Material: Brass.
Article: Escutcheon plates, door handles, etc. All types of builders' hardware.
Method of Forming: Cast.
Final Finish: Brushed brass.
Lea Method:

1. 120 set-up wheel.
2. Lea Compound Grade "N" on 10" loose buff at 1500 r.p.m.
3. Lacquering.

Remarks: Lea Method eliminated the additional set-up wheel operation, cut-down buffing, cleaning and drying, and replaced the messy wet scratch brush step.

CASE STUDY #3

Material: Plastic (black Bakelite).
Article: Knife handles.
Method of Forming: Molding.
Final Finish: High lustre.
Lea Method:

1. 180 dry belt sanding to remove heavy gates.
2. Lea Compound Grade "C" on a 10" diameter 1:1 packed muslin buff at 1750 r.p.m., for the removal of the parting line, and the marks at the end from the previous belt operation.
3. Cut-down buffing with Grade 306 Black Learok on a 12" diameter loose muslin buff at 1750 r.p.m.
4. Lustre buffing with Grade 304 Black Learok on a 12" diameter loose muslin buff at 1750 r.p.m.

Remarks: Lea Compound on a packed buff is able to get in and out of finger grips on the handle and remove the parting line without any danger of burning. If a high lustre is not required, the smooth finish produced by Grade 306 Black Learok will be sufficient.

CASE STUDY #4

Material: Brass.
Article: Pocketbook ornaments.
Method of Forming: Stamped from sheet.
Final Finish: Dull gold plate.
Lea Method:

1. Lea Compound Grade "S" on side of 6" medium hard felt wheel at 3600 r.p.m.
2. Lea Compound Grade "S" on 5" cloth buff at 1200 r.p.m.
3. Gold plate.
4. Lacquering.

Remarks: The desired dull finish is produced by the Lea Method without any scratch brushing on the gold plate. The thickness of gold can therefore be decreased.

CASE STUDY #5

Material: Zinc.
Article: Automobile hardware.
Method of Forming: Die casting.
Final Finish: Bright chromium.
Lea Method:

1. 150 set-up wheel on flash.
2. Lea Compound Grade "C" on 12" sewed buff at 2500 r.p.m.
3. Copper plate.
4. Cut and color buffing with Grade 155 Learok.
5. Bright nickel plate.
6. Chromium plate.

Remarks: Flexible polishing with Lea Compound removes the irregularities in the surface left by the hard set-up wheel required to remove sharp, heavy flash. A smooth surface is produced on the zinc without lubrication, minimizing cleaning before plating.

CASE STUDY #6

Material: Zinc.
Article: Interior trim for automobiles.
Method of Forming: Die casting.
Final Finish: Brush nickel plate.

Lea Method:

1. 120 set-up wheel.
2. Lea Compound Grade "C" on 12" pocketed type buff at 1800 r.p.m.
3. Nickel plate.
4. Lea Compound Grade "F" on the same type buff at 1200 to 1500 r.p.m.

Remarks: Flexible polishing with Lea Compound is substituted for cut-down buffing plus wet scratch brushing. The final Lea Compound operation leaves the work ready for assembling without cleaning and drying.

LEA GRIPMASTER®
POLISHING WHEEL CEMENT
matching the high quality of other Lea Products, is now obtainable through
LEA-MICHIGAN, INC.
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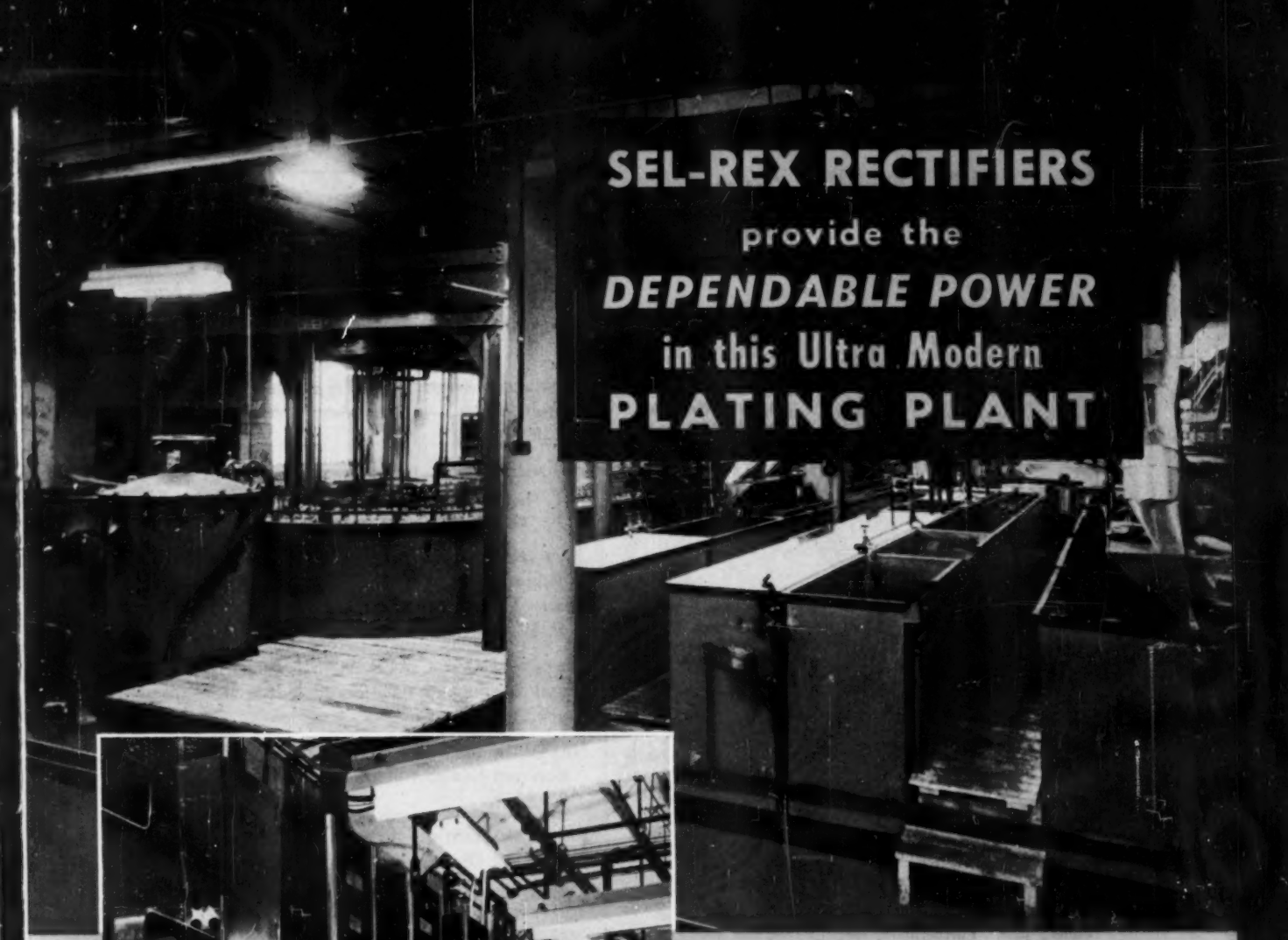

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DEPENDABLE POWER

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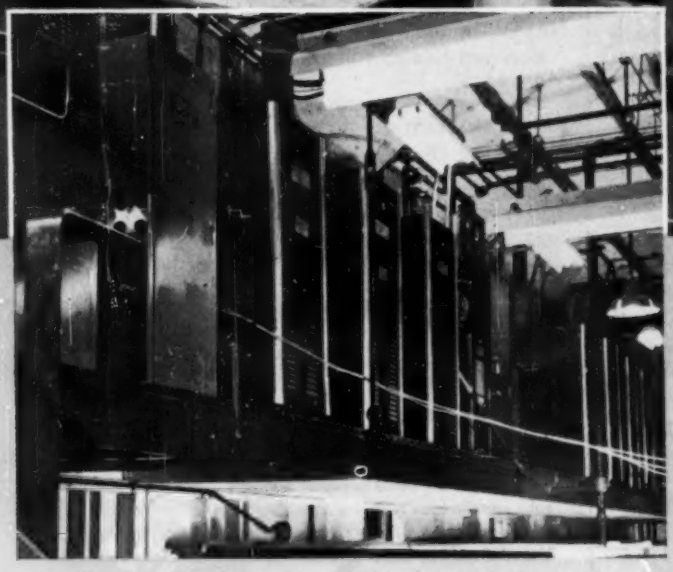

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Sel-Rex Rectifiers afford an efficient and economical power source for every electroplating application because they combine many exclusive design features and are designed and built by plating experts who thoroughly understand the needs of the industry.

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Write today for your copy of "Plating Power", or have a trained technician call to discuss your specific plating problem.

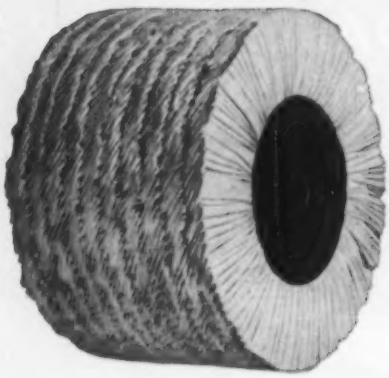
NEMA

BART-MESSING CORPORATION

Dept. PL-12 229 Main Street, Belleville 9, N. J.

A COMPLETE RECTIFIER LINE . . . FROM 25 to 50,000 AMPERES

New "P-40" *Churchill* FINGER-BUFF*



Produced in all types of cloth and in all sizes from 6" to 18" dia.

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Free sample on request.

Pleated construction and angle of pleats of each buff finger enables new "P-40" to hold compound better—cut faster—prevent gouging or streaking of work

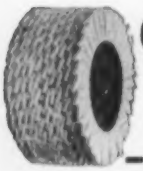
Applying the same principle of "Self-air-cooled" finger-type construction originated by Geo. R. Churchill Co., the new "P-40" Churchill Finger Buff* is constructed by folding the cloth into pleats.

It is this pleated construction that traps and holds the cutting compounds better for all kinds of polishing and buffing jobs. Furthermore, each pleated buff finger is set at the proper angle on the wheel to prevent gouging or streaking of the work.

In addition, the individual buff finger principle is retained to give this new Churchill "P-40" Buffing Wheel the same cooler-running properties that help make Churchill Finger Buffs* wear longer and cost less.

Churchill "P-40's" are priced the same as the regular line of Churchill Finger Buffs*. They are produced in all types of bias cut cloth and in all sizes from 6" to 18" diameters.

When you write for further information please state your buffing problem in detail.



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Please send me FREE catalog and complete information.

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Firm .....

Street .....

City..... Zone..... State.....

Future Meetings

DETROIT BRANCH, AES Annual Educational Session, Friday, December 4, 1953 at 8:00 P. M. Christmas Party, Saturday, December 5, 1953 at 7:00 P. M.

RESEARCH COMMITTEE, AES at the Statler Hotel, Detroit, Mich., on Saturday, December 5, 1953 at 10:00 A. M.

SAN FRANCISCO BRANCH, AES Annual Christmas Party usually held on the second Friday of December in place of the regular meeting.

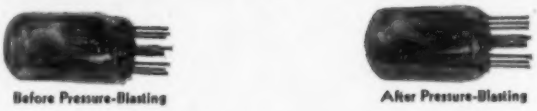
NEWARK BRANCH, AES Annual Educational Session, Friday, December 18, 1953 at 8:00 P. M. and Christmas Party, Saturday, December 19, 1953 at 7:00 P. M., both at the Robert Treat Hotel.

CHICAGO BRANCH, AES Annual Educational Session and Banquet at the Conrad Hilton Hotel on January 31, 1954.

GRAND RAPIDS BRANCH, AES Annual Educational Session and Banquet at the Pantlind Hotel on January 23, 1954.

INTERIM MEETING, AES at the Royal York Hotel, Toronto, Ontario, Canada on February 13, 1954 at 10:00 A. M.

Pressure Blast Application #103



Before Pressure-Blasting — After Pressure-Blasting

Good soldering bond between the pure nickel terminals of this tube and the tube base was a problem because of the toughness of the scale formation. Pressure Blasting cleans this type of delicate work in micro-seconds right down to basis metal with no stock removal or objectionable etching of the glass! Other types of tube terminals finished by Pressure Blast are ready for silver plating immediately after only a cold water rinse.

MODEL A . . . ONE OF 4 STANDARD UNITS. CUSTOM MACHINES DESIGNED TO FIT SPECIAL REQUIREMENTS.

ONLY PRESSURE BLAST GIVES YOU 2-SPEED WET-BLASTING

FREE . . . Learn what PRESSURE BLAST can do for you! Die and Mold Polishing, Blending Grind Lines, Deburring, Heat Treat Scale Removal, Honing of Cutting Tools, Pre-plating Cleaning . . . Hundreds of proven, money-saving applications! Write for our new 8 page fully illustrated Booklet . . . or send samples of work you want tested for.

The CRO-PLATE Company, Incorporated
747-1 Windsor Street
Hartford 5, Conn.

Merry Christmas

The best of Holiday Wishes
and a wee sprig o' heather
for good luck

MAC DERMID
Incorporated
WATERBURY 20, CONNECTICUT

SUPERTARTRAL, in competition with Rochelle Salts or Potassium Tartrate and used in connection with *any* cyanide copper plating operation, offers the following:

- **SUPERIOR** Anode Corrosion, making maximum use of plating metal.
- **SUPERIOR** Solution tolerance to numerous metallic impurities such as Chromium, Calcium, Barium, Magnesium, etc.
- **SUPERIOR** Deposits with less tendency for roughness, caused by metallic impurities such as might be introduced with hard water.
- **SUPERIOR** Cost Savings when used at recommended concentration; where operating characteristics of standard and bright baths utilize Rochelle Salts at 6 oz./gal., SUPERTARTRAL offers 20% savings over Rochelle Salts and 23% saving over Potassium Tartrate.
- **SUPERIOR** Cyanide Stability... Lea-Ronal SUPERTARTRAL reduces cyanide breakdown with its resultant carbonate formation.

SUPERTARTRAL has been thoroughly and successfully *production* tested in still tank and barrel installations of conventional and bright cyanide copper processes, including the widely used Lea-Ronal Bright Copper Process.

LEA-RONAL Products are the result of careful research and development which guarantees that they are not put on the market until ready.

Don't you think that your constant search for improving plating operations and for lowering costs, warrants thorough investigation and trial of LEA-RONAL SUPERTARTRAL?

*Trade Mark Applied for
Patents and Patent Pending

The
LEA GROUP
serving the Finishing Field
LEA-RONAL, INC.
The Lea Mfg. Co., Waterbury, Conn.
Lea-Michigan, Inc., Detroit
Lea Mfg. Co., of Canada, Toronto
Plating Polishing Buffing
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